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## Scrap Heap Philosophy.

Every shop has a scrap heap. The uses of a scrap heap are numerous, but the general object of a scrap heap is to receive all material, such as pieces of iron and steel, chips and bits of metal from lathes and planers, as well as all the old trash that accumulates about the shop in doing a general class of work and jobbing. When the scrap heap gets so large as to encroach too much upon the room required for carrying on the legitimate business of the shop, the junk dealer is called in, and the whole lot disposed of, unless the shop is of a sufficient capacity and has facilities for working up scrap metal. The scrap heap is generally avoided as much as possible by the workmen for some unaccountable reason; but, if they would only consider for a moment, they would realize the fact that the scrap heap is one of the most instructive features about a shop. For example, suppose a new machine is built for performing some heavy work. If built too light, it will either break or require a replacing of the weaker portions, the rejected parts always being consigned to the scrap heap, as well as all the broken parts of machinery, old and obsolete machines and devices. Every engineer and machinist should carefully study the scrap heap, making notes and sketches of each observation; for no person can fill the position of a constructing civil or mechanical engineer with satisfaction to himself and honor to his profession who has not seen things break. To find the weak parts of machinery and braces of different shapes, study the scrap heap. For the most valuable practical lessons in the strength of materials and suggestions in regard to the proportions of machine construction, study the scrap heap. One of the most valuable points to be observed by the young engineer or mechanic in starting out in life, and one which we wish to strongly emphasize is, *don't neglect to study the scrap heap.* In some shops the scrap heap is not only made a receptacle for all that should properly go there, but for many things, such as wrenches, parts of machines, nuts, bolts and washers, which are carelessly thrown into the scrap heap by sweepers and laborers about the shop.

We once worked in a shop where it was generally understood that, when a tool or a part of machinery was missing, it might, in nearly every case, be found in the scrap heap. Under such circumstances, the scrap heap is a rather extravagant affair; for frequently an article might not be required until after the scrap heap had been removed, when it would be too late to recover the lost piece.

In other shops the scrap heap is made to perform certain offices. In some places everything, except finished work, about the shop, which is not required for immediate use, is thrown indiscriminately into the scrap heap. When a job comes in which requires a piece of material, the first step is to carefully examine the scrap heap to see if there is anything there that can be made to answer the purpose.

One shop within our experience was owned by an old gentleman so good natured and even tempered that he was never known to have been disturbed or ruffled about his work. No matter what occurred in the shop, the proprietor always had some way to overcome the difficulty. But he, like every other manufacturer, had a scrap heap, which reflected his weak point. All the experimental machinery which had failed was consigned to the scrap heap. This old gentleman took charge of his shop in person, having a foreman, of course; and when a new forging or casting was required, before taking any steps to secure it, a careful search was made through the scrap heap to see if a piece of the kind wanted could not be found.

A SEARCH THROUGH THE SCRAP HEAP.

This individual would send a man to look for the desired piece of metal, and if the man was a new hand in the shop and failed to find a piece that would do, an old hand was called who thoroughly understood that particular scrap heap. After the old hand had made an unsuccessful search, the proprietor would declare that he was positive the piece of work was there, and he would then direct the men to stand aside while he himself carefully manipulated and measured each piece of metal which bore any resemblance at all to that desired. Our artist happened along just at this period in the proceedings, and sketched the individuals alluded to with remarkable accuracy, as will be observed in the accompanying engraving. The good-natured old gentleman is seen overhauling the scrap heap; the old hand, previously mentioned, stands with arms folded, knowing that the old man cannot find what he is looking for; while the new hand looks first at the boss, then at the composed attitude of his fellow workman, wondering what will be the result. After a long fruitless search the old gentleman finally comes across a piece which he declares, with some alteration, can be used to advantage.

A piece of work produced under these circumstances usually costs more, and is of less value than a forging or casting made of new material at first; moreover, when done, the product of the scrap heap is not exactly what is wanted.

We remember on one occasion having looked all about this shop for nearly two hours in trying to find a half-inch washer and did not succeed. In the previous instance cited two men were losing valuable time, while the boss attempted to do the work he believed his men had failed to perform. This procedure was unjust to the men who had conscientiously endeavored to carry out his orders. The proprietor showed a lack of confidence in his men, and they realized it; and on the whole he made a very extravagant use of his scrap heap.

When a piece of work is condemned, it should be thrown in the scrap heap *to remain there.* It does not pay to put old crystallized iron into a machine where it will endanger life and property. For example, in a certain railroad shop the master mechanic had the same propensity as our aged friend, who appears in the engraving, for gathering up all the old bolts about the shop, and having them spread out upon the floor of the round house. When a locomotive required a bolt, the scrap heap was examined and one found, which was substituted for the broken one. One day a rod bolt was broken upon one of the locomotives. The scrap heap was made to produce one to take its place. The locomotive went out, the bolt broke and let one end of the rod loose, which stripped the entire side of the locomotive, greatly endangering the engineer, who barely escaped with his life. A subsequent examination revealed the fact that the rod bolt substituted was old and crystallized when put in, and had it been closely examined previously would have been consigned to the scrap heap for all future time.

## Cone Pulley Diameters.

No. I.


BY J. F. KLEIN, D. E.,
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When two cone pulleys are connected by an open belt, it is not only desirable that the diameters of the steps be so chosen that the belt will have the same tension on all the steps, but that the two cones should be alike, so that they may be cast from a single pattern. Moreover, as a matter of looks, it is desirable that the differences of diameter of the adjacent steps of a cone should be as nearly alike as the above-mentioned requirements will permit.

We will not here demonstrate that the first two requirements can be exactly fulfilled, but will give, instead, the two tables (page 2) which we have calculated for cone pulleys having six and five steps respectively.

The numbers given in the tables are the differences between the diameters of the adjacent steps on either cone pulley, and are accurate within half a hundredth of an inch (=.005), which in the present case is a degree of accuracy exceeding the requirements of practice.

By simply omitting a step at each end of the cone, the two tables given will be found equally well adapted for determining the diameters of cones having four and three steps respectively.

We will now illustrate the use of the tables by a few examples.

EXAMPLE 1. Suppose the centers of the pulley shafts to be 60″ apart, and that the average difference between the adjacent steps is to be 2½″; also that each cone is to have six steps, the smallest having a diameter equal to 5″. To find the remaining dia-

meters we look in Table I. (corresponding to cone pulleys with six steps), under 60″ and opposite 2½″, and obtain the differences,

2.37 2.43 2.50 2.57 2.63

Each of these differences is added to the smaller diameter of the two adjacent steps to which it corresponds, thus:

| | | | | |
|---|---|---|---|---|
| 5. | 7.37 | 9.80 | 12.30 | 14.87 |
| 2.37 | 2.43 | 2.50 | 2.57 | 2.63 |
| 7.37 | 9.80 | 12.30 | 14.87 | 17.50 |

These sums representing the actual diameters of the second, third, fourth, fifth and sixth steps respectively.

Example 2. If we suppose the same conditions as in Example 1, with the exception that each cone is to have four steps instead of six, we obtain the required diameters by omitting the end differences of the above example, and then adding the remaining differences as follows:

| | | |
|---|---|---|
| 5. | 7.43 | 9.93 |
| 2.43 | 2.50 | 2.57 |
| 7.43 | 9.93 | 12.50 |

These sums—7.43″, 9.93″ and 12.50″—represent the actual diameters of second, third and fourth steps respectively. If the smallest diameter had not been assumed equal to 5″, we might have dropped a step at each end of the six-stepped cone of the preceding example, and employed the remaining four diameters—7.37″, 9.80″, 12.30″ and 14.87″—for one four-step cone.

The present and the previous examples show that we can assume the size of the smallest step anything that we please, and, other things being equal, can make the required cones large or small.

Example 3. Let distance apart of the centers=30″, the average difference between adjacent steps=2″, the smallest steps have a diameter=4″, and the number of steps on each cone pulley=5, then from Table II., under 30″ and opposite 2″, we obtain the differences

1.87 1.96 2.04 2.13

and then, adding as before, we get the required diameters,

4″ 5.87″ 7.83″ 9.87″ 12.00″

Example 4. Let the conditions be as in the preceding example, the cone pulley having, however, three steps instead of five, then dropping the end differences and adding

| | |
|---|---|
| 4 | 5.96 |
| 1.96 | 2.04 |
| 5.96 | 8.00 |

we get 4″, 5.96″ and 8″ as the diameters of the cone.

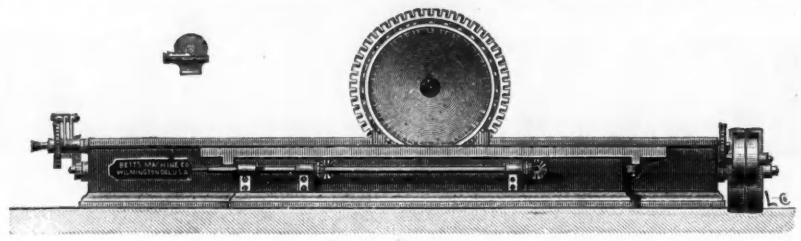
Example 5. Let the distance apart of the centers be 60″, the average difference between the adjacent steps be 2⅛″, the smallest step 7″, and the number of steps=5. Now, an inspection of Table II. will show that it contains no horizontal lines corresponding to the average difference 2⅛″, we cannot therefore, as heretofore, obtain the required differences directly, but must interpolate as follows: Since 2¼″ is quarter way between 2″ and 2½″, the numbers corresponding to 2¼″ (for any given distance apart of the centers) will be quarter way between the numbers of the table corresponding to 2″ and 2½″. Thus, in Table II., we have under 60″ and

| | | | | | |
|---|---|---|---|---|---|
| opposite | 2½″, | 2.40 | 2.47 | 2.53 | 2.60 |
| " | 2″, | 1.93 | 1.98 | 2.02 | 2.07 |
| | | .47 | .49 | .51 | .53 |

Dividing these differences by 4, we get:

| | | | | |
|---|---|---|---|---|
| | .12 | .12 | .13 | .13 |
| to which we add | 1.93 | 1.98 | 2.02 | 2.07 |
| and get for the differences corresponding to 2⅛″, | | | | |
| | 2.05 | 2.10 | 2.15 | 2.20 |
| adding as before | 7. | 9.05 | 11.15 | 13.30 |
| the dia. will be 7″ | 9.05″ | 11.15″ | 13.30″ | 15.50″ |

When we assume a given velocity ratio when the belt is at one end of the cones, and also assume the diameter of the smallest step, we can easily obtain the largest step by multiplying the smallest one (increased by thickness of belt) by the assumed velocity ratio; the difference between the largest and smallest steps, divided by the number of steps less one, will give the average differences between the steps; we can then proceed as in the above examples.



New Rotary Planer.

## New Rotary Planer.

For many kinds of iron work, such as facing plain surfaces on columns and chords, also different classes of architectural work, the rotary planer undoubtedly possesses some special advantages over the usual or reciprocating planer. Such a machine is also of value in iron bridge building and many other jobs where a large number of pieces of the same kind are required. In the accompanying engraving a rotary planer is represented, which is calculated to face a surface 25″ high and 11 feet long. This planer consists of a strong bed plate, to which is gibbed a traveling head, carrying a heavy plate wheel banded with wrought iron and hung upon a stout steel spindle. This wheel has 28 cutters and is driven by a worm and wheel. The work is to be bolted to the table attached to the side of the bed, when the traveling head, being fed along by a screw, faces off the work, which remains stationary. Where there are a number of pieces attached to the table, as soon as the cutters have passed over one piece it may be removed, and replaced by another without stopping the machine. A great deal of valuable time is thus saved by filling the table as fast as the pieces are faced, and keeping the machine constantly at work. This machine has a variable automatic feed, and the head is moved back by an independent countershaft. This style of machine is made in different sizes, the larger one being capable of facing a surface 32″ high and 14 feet long. The head of this machine has 36 cutters. An apparatus for grinding the cutters is furnished with each machine. They are made by the Betts Machine Company, Wilmington, Del.

### I.—Table for Finding Cone-Pulley Diameters

when the two pulleys are connected by an open belt and are exactly alike. The numbers given in table are the differences between the diameters of the adjacent steps on either cone pulley, and can be employed when there are either Six or Four steps on a cone.

| Average difference between the adjacent steps. | Adjacent steps whose difference is given in table. | Distance Between the Centers of Cone Pulleys. 30″ | 40″ | 50″ | 60″ | 70″ | 80″ | 90″ | 100″ | 110″ | 120″ | 180″ | 240″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½″ | 1st and 2d | 1.40 | 1.43 | 1.44 | 1.45 | 1.46 | 1.46 | 1.47 | 1.47 | 1.47 | 1.48 | 1.48 | 1.49 |
| | 2d " 3d | 1.45 | 1.46 | 1.47 | 1.48 | 1.48 | 1.48 | 1.49 | 1.49 | 1.49 | 1.49 | 1.49 | 1.49 |
| | 3d " 4th | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 |
| | 4th " 5th | 1.55 | 1.54 | 1.53 | 1.52 | 1.52 | 1.52 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 |
| | 5th " 6th | 1.60 | 1.57 | 1.56 | 1.55 | 1.54 | 1.54 | 1.53 | 1.53 | 1.53 | 1.52 | 1.52 | 1.51 |
| 2″ | 1st and 2d | 1.83 | 1.87 | 1.90 | 1.91 | 1.93 | 1.93 | 1.94 | 1.95 | 1.95 | 1.96 | 1.97 | 1.98 |
| | 2d " 3d | 1.92 | 1.94 | 1.95 | 1.96 | 1.96 | 1.97 | 1.97 | 1.97 | 1.98 | 1.98 | 1.99 | 1.99 |
| | 3d " 4th | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| | 4th " 5th | 2.08 | 2.06 | 2.05 | 2.04 | 2.04 | 2.03 | 2.03 | 2 03 | 2.02 | 2.02 | 2.01 | 2.01 |
| | 5th " 6th | 2.17 | 2.13 | 2.10 | 2.09 | 2.07 | 2.07 | 2.06 | 2.05 | 2.05 | 2.04 | 2.03 | 2.02 |
| 2½″ | 1st and 2d | 2.23 | 2.30 | 2.34 | 2.37 | 2.39 | 2.40 | 2.41 | 2.42 | 2.42 | 2.43 | 2.46 | 2.47 |
| | 2d " 3d | 2.37 | 2.40 | 2.42 | 2.43 | 2.44 | 2.45 | 2.46 | 2.46 | 2.46 | 2.47 | 2.48 | 2.49 |
| | 3d " 4th | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| | 4th " 5th | 2.63 | 2.60 | 2.58 | 2.57 | 2.56 | 2.55 | 2.54 | 2.54 | 2.54 | 2.53 | 2.52 | 2.52 |
| | 5th " 6th | 2.77 | 2.70 | 2.66 | 2.63 | 2.61 | 2.60 | 2.59 | 2.58 | 2.58 | 2.57 | 2.54 | 2.53 |
| 3″ | 1st and 2d | 2.62 | 2.71 | 2.77 | 2.81 | 2.84 | 2.86 | 2.87 | 2.89 | 2.89 | 2.90 | 2.93 | 2.95 |
| | 2d " 3d | 2.81 | 2.86 | 2.88 | 2.90 | 2.92 | 2.93 | 2.94 | 2.94 | 2.95 | 2.95 | 2.97 | 2.98 |
| | 3d " 4th | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| | 4th " 5th | 3.19 | 3.15 | 3.12 | 3.10 | 3.08 | 3.07 | 3.06 | 3.06 | 3.05 | 3.05 | 3.03 | 3.02 |
| | 5th " 6th | 3.39 | 3.29 | 3.23 | 3.19 | 3.16 | 3.14 | 3.13 | 3.11 | 3.11 | 3.10 | 3.07 | 3.05 |
| 4″ | 1st and 2d | 3.31 | 3.49 | 3.59 | 3.66 | 3.71 | 3.75 | 3.78 | 3.80 | 3.81 | 3.83 | 3.88 | 3.91 |
| | 2d " 3d | 3.66 | 3.75 | 3.80 | 3.83 | 3.85 | 3.87 | 3.88 | 3.89 | 3.91 | 3.92 | 3.94 | 3.96 |
| | 3d " 4th | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| | 4th " 5th | 4.34 | 4.26 | 4.20 | 4.17 | 4.15 | 4.13 | 4.12 | 4.11 | 4.09 | 4.08 | 4.06 | 4.04 |
| | 5th " 6th | 4.69 | 4.51 | 4.41 | 4.34 | 4.29 | 4.25 | 4.22 | 4.20 | 4.19 | 4.18 | 4.12 | 4.09 |
| 5″ | 1st and 2d | 3.92 | 4.20 | 4.36 | 4.46 | 4.55 | 4.60 | 4.64 | 4.68 | 4.71 | 4.74 | 4.82 | 4.87 |
| | 2d " 3d | 4.47 | 4.60 | 4.68 | 4.74 | 4.77 | 4.80 | 4.82 | 4.84 | 4.85 | 4.86 | 4.91 | 4.93 |
| | 3d " 4th | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| | 4th " 5th | 5.58 | 5.40 | 5.32 | 5.27 | 5.23 | 5.20 | 5.18 | 5.16 | 5.15 | 5.14 | 5.09 | 5.07 |
| | 5th " 6th | 6.09 | 5.80 | 5.64 | 5.54 | 5.45 | 5.40 | 5.36 | 5.32 | 5.29 | 5.26 | 5.18 | 5.13 |
| 6″ | 1st and 2d | 4.42 | 4.83 | 5.08 | 5.23 | 5.34 | 5.42 | 5.49 | 5.55 | 5.58 | 5.62 | 5.74 | 5.80 |
| | 2d " 3d | 5.23 | 5.42 | 5.54 | 5.62 | 5.67 | 5.71 | 5.75 | 5.77 | 5.79 | 5.81 | 5.87 | 5.90 |
| | 3d " 4th | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 |
| | 4th " 5th | 6.77 | 6.58 | 6.46 | 6.38 | 6.33 | 6.29 | 6.25 | 6.23 | 6.21 | 6.19 | 6.13 | 6.10 |
| | 5th " 6th | 7.58 | 7.17 | 6.92 | 6.77 | 6.66 | 6.58 | 6.51 | 6.45 | 6.42 | 6.38 | 6.26 | 6.20 |

### II.—Table for Finding Cone Pulley Diameters

when the two pulleys are connected by an *open* belt, and are exactly alike. The numbers given in table are the differences between the diameters of the adjacent steps on either cone pulley, and can be employed when there are either Five or Three Steps on a Cone.

| Average difference between the adjacent steps. | Adjacent steps whose difference is given in table. | Distance Between the Centers of Cone Pulleys. 30″ | 40″ | 50″ | 60″ | 70″ | 80″ | 90″ | 100″ | 110″ | 120″ | 180″ | 240″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½″ | 1st and 2d | 1.43 | 1.45 | 1.45 | 1.46 | 1.47 | 1.47 | 1.48 | 1.48 | 1.48 | 1.48 | 1.49 | 1.49 |
| | 2d " 3d | 1.48 | 1.48 | 1.48 | 1.49 | 1.49 | 1.49 | 1.89 | 1.49 | 1.49 | 1.49 | 1.49 | 1.49 |
| | 3d " 4th | 1.52 | 1.52 | 1.52 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 | 1.51 |
| | 4th " 5th | 1.57 | 1.55 | 1.55 | 1.54 | 1.53 | 1.53 | 1.52 | 1.52 | 1.52 | 1.52 | 1.51 | 1.51 |
| 2″ | 1st and 2d | 1.87 | 1.90 | 1.92 | 1.93 | 1.94 | 1.95 | 1.96 | 1.96 | 1.97 | 1.97 | 1.98 | 1.98 |
| | 2d " 3d | 1.96 | 1.97 | 1.97 | 1.98 | 1.98 | 1.98 | 1.99 | 1.99 | 1.99 | 1.99 | 1.99 | 1.99 |
| | 3d " 4th | 2.04 | 2.03 | 2.03 | 2.02 | 2.02 | 2.02 | 2.01 | 2.01 | 2.01 | 2.01 | 2.01 | 2.01 |
| | 4th " 5th | 2.13 | 2.10 | 2.08 | 2.07 | 2.06 | 2.05 | 2.04 | 2.04 | 2.03 | 2.03 | 2.02 | 2.02 |
| 2½″ | 1st and 2d | 2.30 | 2.38 | 2.38 | 2.40 | 2.41 | 2.42 | 2.43 | 2.44 | 2.45 | 2.45 | 2.47 | 2.47 |
| | 2d " 3d | 2.43 | 2.45 | 2.46 | 2.47 | 2.47 | 2.47 | 2.48 | 2.48 | 2.48 | 2.48 | 2.49 | 2.49 |
| | 3d " 4th | 2.57 | 2.55 | 2.54 | 2.53 | 2.53 | 2.53 | 2.52 | 2.52 | 2.52 | 2.52 | 2.51 | 2.51 |
| | 4th " 5th | 2.70 | 2.63 | 2.62 | 2.60 | 2.59 | 2.58 | 2.57 | 2.56 | 2.55 | 2.55 | 2.53 | 2.53 |
| 3″ | 1st and 2d | 2.71 | 2.78 | 2.83 | 2.86 | 2.87 | 2.89 | 2.90 | 2.91 | 2.92 | 2.93 | 2.95 | 2.96 |
| | 2d " 3d | 2.90 | 2.93 | 2.94 | 2.95 | 2.96 | 2.96 | 2.97 | 2.97 | 2.97 | 2.98 | 2.98 | 2.99 |
| | 3d " 4th | 3.10 | 3.07 | 3.06 | 3.05 | 3.04 | 3.04 | 3.03 | 3.03 | 3.03 | 3.02 | 3.02 | 3.01 |
| | 4th " 5th | 3.29 | 3.22 | 3.17 | 3.14 | 3.13 | 3.11 | 3.10 | 3.09 | 3.08 | 3.07 | 3.05 | 3.04 |
| 4″ | 1st and 2d | 3.49 | 3.62 | 3.69 | 3.75 | 3.78 | 3.81 | 3.83 | 3.84 | 3.86 | 3.87 | 3.91 | 3.94 |
| | 2d " 3d | 3.83 | 3.87 | 3.90 | 3.91 | 3.92 | 3.94 | 3.94 | 3.95 | 3.95 | 3.96 | 3.97 | 3.98 |
| | 3d " 4th | 4.17 | 4.13 | 4.10 | 4.09 | 4.08 | 4.06 | 4.06 | 4.05 | 4.05 | 4.04 | 4.03 | 4.02 |
| | 4th " 5th | 4.51 | 4.38 | 4.31 | 4.25 | 4.22 | 4.19 | 4.17 | 4.16 | 4.14 | 4.13 | 4.09 | 4.06 |
| 5″ | 1st and 2d | 4.20 | 4.40 | 4.52 | 4.60 | 4.66 | 4.71 | 4.73 | 4.76 | 4.78 | 4.80 | 4.86 | 4.90 |
| | 2d " 3d | 4.73 | 4.80 | 4.84 | 4.87 | 4.89 | 4.90 | 4.91 | 4.92 | 4.93 | 4.93 | 4.95 | 4.96 |
| | 3d " 4th | 5.27 | 5.20 | 5.16 | 5.13 | 5.11 | 5.10 | 5.09 | 5.08 | 5.07 | 5.07 | 5.05 | 5.04 |
| | 4th " 5th | 5.80 | 5.60 | 5.48 | 5.40 | 5.34 | 5.29 | 5.27 | 5.24 | 5.22 | 5.20 | 5.14 | 5.10 |
| 6″ | 1st and 2d | 4.83 | 5.13 | 5.31 | 5.42 | 5.51 | 5.57 | 5.62 | 5.66 | 5.69 | 5.71 | 5.79 | 5.86 |
| | 2d " 3d | 5.62 | 5.71 | 5.77 | 5.81 | 5.83 | 5.86 | 5.87 | 5.88 | 5.89 | 5.90 | 5.93 | 5.95 |
| | 3d " 4th | 6.38 | 6.29 | 6.23 | 6.19 | 6.17 | 6.14 | 6.13 | 6.12 | 6.11 | 6 10 | 6.07 | 6.05 |
| | 4th " 5th | 7.17 | 6.87 | 6.69 | 6.58 | 6.49 | 6.43 | 6.38 | 6.34 | 6.31 | 6.29 | 6.21 | 6.14 |

## A Paper Diet and Paper Steam Engine.

The *Courier Journal*, of Louisville, has an article on the display of paper articles at the Cincinnati Exposition. The reporter of that paper interviewed Mr. Ross, of the Bremaker-Moore Paper Co., making the exhibit. We make the following extract:

"A bedstead made of paper looks beautiful, and is everlasting. It is made in the same manner as the car wheels, only they are made out of long strips of paper, instead of paper rings. Another very valuable article which can be made out of paper is a cooking or heating stove. These paper stoves are annealed, and it is impossible to burn them out, and they are much cheaper than iron."

"You can do almost anything with paper but eat it," remarked the reporter.

"All but eat it," said Mr. Ross, with an exclamation of surprise, "why I have eaten it, and liked it very much. I took a large amount of it prepared like mush, and ate it in soup, and found it very palatable. I tell you you can make or do almost anything with paper. When I build another house, I intend to build it from foundation stone to roof out of paper. We can make a house out of paper, and one that will last forever, furnish it finely with paper furniture, make all the dishes, stoves, knives and forks, and all other articles in the house out of paper. I have frequently noticed and admired the *Courier-Journal* building, and it might be somewhat strange when I state that a building just like it could be erected out of paper, only it would be much more durable. The printing press, cases, type, and all the fixtures of the office could be made out of paper, and would be much cheaper than the ordinary ones, as well as more durable. Another thing which can be made out of paper is a complete steam engine, which would do all the duties of a metal one, and last longer. The fact of the matter is that there is not an article that cannot be made, and splendidly made, out of paper. I think it is by far the most useful thing in the world. The time it takes to transform a linen fiber into a fine car wheel or other article is twenty-nine hours. It will take some little time longer to make paper clothes and shoes."

A rural visitor at a Hartford factory mistook the fire extinguisher for the water cooler recently, and it took half an hour to convince him that the boiler had not exploded.

A "national trade union congress" is to be held in Pittsburgh on the third Tuesday in November, 1881. Each local union will be entitled to one delegate for one hundred members or less, and one additional delegate for each additional five hundred members, or major part thereof.

## Hints on Making Ready for Cylinder Presses.

In the American Machinist of August 13, 1881, we quoted from the new illustrated catalogue of printing presses and printers' materials recently issued by R. Hoe & Co., the preliminary directions towards making ready newspaper forms.

Probably few of our readers, who are accustomed to seeing the news of the day brought up to within an hour or two by the daily newspapers, realize the skill and painstaking required to prepare such pages as those in the American Machinist for printing. This style and quality of printing is known as book work, but the addition of illustrations requires about three times as long to make ready as it does on regular book work, where the illustrations are few or none.

In book printing the illustrations are frequently printed separately from the letter press, or regular printed pages, and upon different paper. In an illustrated paper, however, the type matter and illustrations are printed by the same impression.

The extra time required to make ready is, of course, increased by the number of illustrations, each of which have to be carefully packed up in order to bring out the details in printing. The time given to making ready for fine book work cannot, of course, be

taken upon a weekly newspaper containing so many illustrations, consisting principally of wood cuts, and so much original matter. The size of our present edition is now 13,000 copies, and six rollers pass over each page twice for each impression or page printed, each cut and form coming in contact with a roller 156,000 times in running off an edition.

All this is done without destroying the delicate shadings which the pressman has laboriously brought out in the illustrations. From these explanations the reader may get some idea of the constant care that is required upon this kind of work. We continue our extracts from the directions for making ready for cylinder presses given by R. Hoe & Co., in their new catalogue:

16. Weakness of impression may be corrected: 1. By turning down impression screws and putting on more impression, flatting down the high to bring up the low types—obviously a bad method. 2. By raising up the low types or plates with underlays of paper or card. 3 By stretching a thin rubber or woolen blanket over the fast packing, trusting to its elasticity to bring up the types that do not show. 4. By pasting overlays of paper of one or more thicknesses over every part of the packing that shows weakness.

17. The method of forcing impression by means of the impression screws is mentioned only to be condemned. A large form of wood type, of old plates, of diagrams on black ground, which has to be printed in haste may seem to justify the turning of the screws; but the method is radically bad, as destructive to the press as to the type. The impression screws should be used for this purpose only in rare emergencies, and as the last resort. If they are frequently tampered with, the even bearing of the cylinder will soon be lost; the press will be strained in false bearings, and made incapable of giving even impressions.

18. The extra impression that may be required for work in haste can be quickest had by putting on a thin rubber or woolen blanket over the fast packing. This is a common but an unworkmanlike method. The extra blanket will shorten making-ready, but it wears the types or plates, and makes thick, coarse presswork. It is useful only on short editions. On a long edition the extra blanket will lose its elasticity before the work is half done; it will pack hard and require renewal. The single rubber blanket provided for the press is elastic enough for ordinary work. If it is not enough, put more paper over the fast packing. Avoid the common fault of novices, who put on too much impression at the start. *Making ready for fine work should always begin with a light impression.* When the full force of the press is not exerted at the start, it is always easy, at any stage of making ready, to overlay and increase impression anywhere. But when impression is full at the start, it is often impossible to take it off any point without destroying all the making-ready that has been done.

19. Find out whether the presswork desired is to be common, good or fine, and how much time can be allowed for making-ready. The time allowed must determine the quality of the work. Begin by bringing up with underlays all lines of types or plates that are low. The underlay is to be preferred to the overlay only when it brings the low matter up to the inking rollers as well as to impression. Cut underlays from proofs, which will show you where to cut and where to fasten them. The proper size and thickness of an underlay can be known only by experiment. Cut out of a proof every feebly-printed spot, and fasten the part cut out on the feet of the type. The proof taken after such an underlay has been affixed should show improvement; but the center may be, probably will be, still too feeble. To correct this, cut another underlay from the second proof, which will be of smaller size, and put it under the first. If this is not enough, cut and put on a third, taking care that the smallest shall always be next to the bed of the press. Avoid underlaying any part of the form which shows up fairly on the proof. At this stage of the work, do not put a needlessly thick underlay under a heavy-faced cut or type, because you think it will need much impression. This extra impression will be most fairly given by an overlay. Do not put a thick underlay under the corner or under one-half of a large type; for, if the type rocks or tilts, as it probably will, under impression, the tilting will work up the furniture and quadrats. Use but little paste, for the moisture in it will swell the wood it touches. For very low lines or blocks, cardboard is better than paper. Put all underlays on smoothly, without fold or wrinkle. When plates are on patent blocks, underlays may be freely used with excellent results; but the underlay should always be between the plate and the block. An underlay for a plate on a block should always be cut smaller than is indicated by the feeble spot on the proof, for there is a spring in the plate beyond the surface underlaid which will make up the deficiency. Do not underlay too much; one-fourth the surface of a type form is a large allowance. If more is attempted, the form is made springy, and this springiness will surely work up furniture.

20. Some of the finishing work in underlaying, previously directed for plate forms, can be done more neatly on type forms by use of overlays. Where choice can be had, use overlays; the office of the underlay is the bringing up of low types or plates to inking rollers and reasonably even impression; the office of the overlay, the giving of finish and delicacy to impression.

21. To overlay a form, first paste upon the gripper edge of the cylinder two sheets of thin, hard paper. Take a pale proof on the paper provided for the work, observing all the directions previously given concerning margins. When margins are correct, take two proofs, one on thick and one on thin paper. Wherever there appears a decided weakness of impression on the proof, cut the weak part out and neatly paste it down on the sheet next to the fast packing. Use a sharp knife and cut upon a smooth surface, making no torn or ragged edges. If the work is fine, pare down the edges, so that the next proof will not show a sudden change of impression surface. Wherever there is but slight feebleness of impression, cut the overlay for it out of thin paper, and affix it in its place. Put on overlays smoothly; they are worse than useless if they bag or wrinkle. If an overlay has been badly placed, regard it as beyond repair. Do not try to patch it; tear all off and begin anew.

22. When the more conspicuous defects of impression have been overlaid, take other proofs on thin paper, and examine them for minor faults. From these proofs cut new overlays, which put on in the same manner, until a sufficiently even impression is obtained. If, at any stage of the work, any rule or letter shows too high, cut it out of the packing sheets. If this cutting out does not sufficiently reduce impression, have the faulty letter taken out of the form, and have the batter (the usual cause) cut off.

23. For all work on wet paper, printed against an elastic packing, overlays may be cut in large masses. For fine work, on dry paper, against hard packing, the overlays should be smaller and on thin paper. For the finest work overlays are often needed for single letters and parts of letters, and they should often be of tissue paper.

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It has apparently remained for electricity to disturb the traditions of that peculiarly English institution, the treadmill. The latest move is to utilize the wasted energy of English prisoners—energy that has hitherto had for its ultimate object "making the wheels go around." With this purpose in view, Mr. B. G. Jenkins, F. R. A. S., proposes that a Gramme machine be geared to the treadmill, and the energy stored up in the form of electricity by means of a Taure accumulator. In the event of the success of this enterprise, our own genial countryman may feel called upon to give us a new version of the "Song," a proceeding to which there will probably be no objection.

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A daily paper thus proceeds to cast reflections on one of the prime mechanical powers:

Many a bad man rests the lever of hypocrisy upon the fulcrum of religion to help him raise the devil.

## A New Small Gear Cutter.

Many machine shops that do not have constant use for a gear cutting engine, have felt the need of a small machine adapted to do a considerable variety of work, and that should be moderate in price. The accompanying engraving represents a tool of this class which was designed with a view to meet this demand.

It will cut gears of 22″ or less diameter,

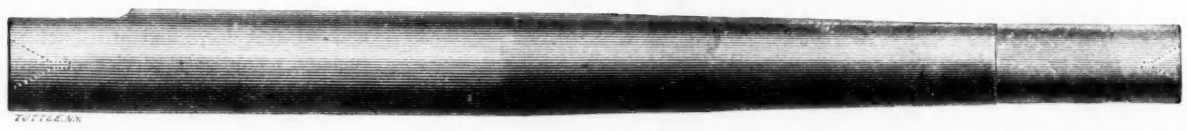
A New Small Gear Cutter.

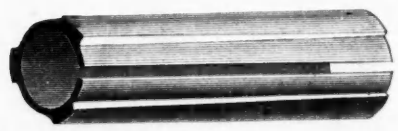
and up to 6 teeth to the inch of diameter; cutting every number to 100, and every even number to 186, working equally well on spur, bevel and worm wheels.

The spindle and screws are of steel, and the bolts and nuts are case-hardened.

It occupies a floor space of only 24″ × 32″, is furnished complete with countershaft and a peculiar device for keeping the belt tight, and is constructed with a view to quick adjustment and easy manipulation.

They are manufactured by D. E. Whiton, West Stafford, Conn.





New Expanding Mandrel.

## A New Expanding Mandrel.

In our issue of Aug. 13, 1881, we illustrated and described a mandrel designed for use in holes of standard sizes—the invention of Mr. J. A. Wilde, of Hudson, N. Y. We present this week a new expanding mandrel, the invention of the same gentleman. By reference to the engraving, it will be seen that the device consists of two parts, viz.: a ribbed split sleeve, and the mandrel proper.

The sleeve, which is made of steel, is pierced with a tapering hole, and one end of the mandrel is turned to exactly fit this hole in the sleeve. The sleeve is then turned to the required diameter—preferably on the mandrel to which it belongs—after which the material is removed by milling or planing, in such a way as to leave three narrow longitudinal bearings with equal depressed spaces between them. These depressions extend very nearly to the bore of the sleeve, leaving only sufficient metal to serve to hold the bearings in position. The sleeve is also cut apart through one of these depressions, leaving it free to contract or expand.

In using this mandrel the sleeve is placed in the hole, when by lightly driving the mandrel into it, it (the sleeve) will be expanded, and the three bearing surfaces will be forced into sufficient contact; their outer surfaces, of course, being equidistant from the center.

It is not claimed for this tool that it is an expanding mandrel, in the sense that a single one may be used for holes of widely different diameters; but it is claimed that the smaller sizes will readily accommodate themselves to holes, that, while nominally of one size, really vary considerably; while the larger sizes will adapt themselves to variations proportionate to their diameters.

It will be seen that this mandrel is simple in construction, its condition of accuracy being entirely determined by the work of the lathe; and that while it can be readily and inexpensively made as required for use in the machine shop, it can also be advantageously manufactured and sold as a standard tool.

## Boston Industrial Exhibitions.

The managers of the Institute Fair deserve a great deal of credit for their enterprise in making the first exhibition such a representative one of New England mechanical products. No one of a mechanical turn of mind can fail to be interested and benefited by a visit. The interest seems to increase after the visitor has spent an hour or more in viewing the articles on exhibition.

"The Woodbury, Merrill, Patten and Woodbury Differential High-Pressure Air Engine" is a machine as original and striking in its general appearance as in the construction of its name. The attendant furnishes visitors a circular, from which we learn that "the material economy of this motor is readily perceived in the fact that it uses but one-half the amount of fuel, per horse power, that is required for steam, and that the estimated expense for repairs will not exceed fifty per cent. of that for the steam engine." The machine shown (which runs some Weston electric lights) is double-acting, having two separate combinations of heater, regenerator and cooler, each working a cylinder. Cooling is performed by passing water around small thin copper tubes, through which the air passes.

As a whole the exhibition is very entertaining and instructive to any one of mechanical tastes.

We next enter the Massachusetts Charitable Mechanic Fair, a short distance from the new Institute Fair on Huntington Avenue. Here the admission fee is 50 cents. In addition to machinery and mechanical products, there is a large art gallery, well supplied with objects of æsthetic taste.

One of the greatest curiosities is an automatic paper collar machine at work. From a roll of prepared paper it makes 148 collars a minute. At every stroke of the die it throws out two collars, complete for wearing, with the exception of a slight folding. The Reversible Collar Co., of Boston, are the exhibitors.

J. A. Salmon, 149a Tremont Street, Boston, shows what seems to be a novelty. It consists of a collection of portable steam heaters, five styles in all, designed for offices, railroad cars, street cars, etc. They are neat, and very easily moved about a room. He also shows a new portable range boiler and heater operated by gas.

One curiosity is a cast steel ingot, weighing 20,000 pounds, apparently without a flaw, cast by the Norway Iron and Steel Works of Boston.

The horizontal tubular boilers which furnish steam to drive the machinery are models of correct proportions and workmanship. They were built by the Whitter Machine Company of Boston, who also have a finely working elevator on exhibition.

C. E. Mayo and W. L. Perry, of Lowell, exhibit a new foot-power treadle applied to various machinery. It operates by friction; is noiseless, and very easily driven.

An assortment of machine-cut small gears, and a peculiar calculating machine, comprise the exhibit of Geo. B. Grant of Boston.

The Hall Type writer shown at the fair is a little machine, 14 × 17 × 2½ inches, and weighs, in walnut case, 5½ pounds. It uses 72 characters, including both capital and small letters, figures, dollar mark, &c. The operator uses a small steel pointer instead of playing upon piano-like keys. Spaces between words are made by touching a key without letting go the pointer.

Very creditable steam pump exhibits are made by H. R. Worthington, the Deane Steam Pump Co., and the Valley Machine Co., of Easthampton, Mass.

The Boston Blower Co. show a variety of sizes and styles of blowers, exhaust fans, shaving exhausters, cupola and forge blowers.

A new combination bench lathe and screw machine is shown by A. C. Winn, 19 Harvard Place, Boston. It has hollow spindle, conical bearings and split chucks, and will also receive a scroll chuck, if desired. For making screws the lathe has a turret attachment.

## Practical Steam Engine Economy.*

(No. 1.)

BY F. F. HEMENWAY.

The designing and constructing of a steam engine for definite results under specific conditions—such as developing a given power on a fixed fuel consumption—is one of the things that may be, and is done with reasonable approach to exactness. The experience of the individual, aided by what little has become known in the effort to get steam engineering towards the condition of a science, enables him to predict, not absolute results, but reasonable approximations. This is something that concerns the designer and builder of steam engines. In the nature of things he aims at economy in its various phases. He does this because he likes to give an honest equivalent; because he takes an honest pride in excelling, and because he is driven to do so by competition. The knowledge he uses comprises what little there is of the science of steam engineering. Not knowledge derived from definite calculations; but for the most part gained from individual experience and experiments by no means complete or satisfactory.

While this knowledge in all its incompleteness is valuable to the constructor, and enables him to predict results with considerable satisfaction, the problem of economy and possibility sometimes presents itself to the user in a manner quite different.

The purchaser, for instance, requires a hundred horse-power engine, and stipulates that he shall get his power from a certain coal consumption. The builder has, then, two conditions, viz., the power required and the coal consumption agreed upon, and he fills the space between them by constructing in harmony with them. That is, he makes the steam pressure, piston speed and dimensions such as accord with his views and practice, and he obtains certain effects from the combination of certain causes supposed to represent a fair approach to harmony.

The problem liable to present itself at any time to the user is, how to *restore* harmony when some of the original conditions are changed? The condition most likely to be changed is the power required. He may have correctly estimated his work in the beginning, and find, after a year or two, that it is desirable to add to it materially, or he may underestimate it in the beginning; but, what is more likely still, he will grossly overestimate it. However this may be, when the builder sells an engine to develop a certain power at a fixed coal consumption, he has—no matter what his private views may be—no safety except in building to contract. He may be called upon to verify his statements. In reference to the problem the user has to do with: Suppose, as an instance, he has an engine working at 100 horse power, it having been designed and sold for a hundred horse power engine, and he wants to increase the load by, say, 50 horse power. He has to consider, first, can he do it? and, second, what is the best way to do it? According to much modern practice, a non-condensing automatic engine, working under initial pressure of 80 pounds. should show a mean effective pressure of 35 pounds, corresponding to a cut off at about $\frac{1}{5}$ stroke. There are, at least, four plans to get the extra 50 horse power from such an engine, either of which may be all wrong or all right; as, first: Increase the mean effective pressure by allowing a later cut off. Of this plan it may be said that, since in this class of engines the steam is admitted at boiler pressure without reference to the load, the strains will not be materially changed in *intensity*, whatever the variation in load. Hence, the strength of the different parts need not be considered.

In reference to fuel economy, the difference between the engine at its normal condition—100 horse power—and at 150 horse power would be very slight. But economy in the use of fuel is at the most only a single point in steam engine economy. Always important, it is nevertheless sometimes the least so of all economic considerations.

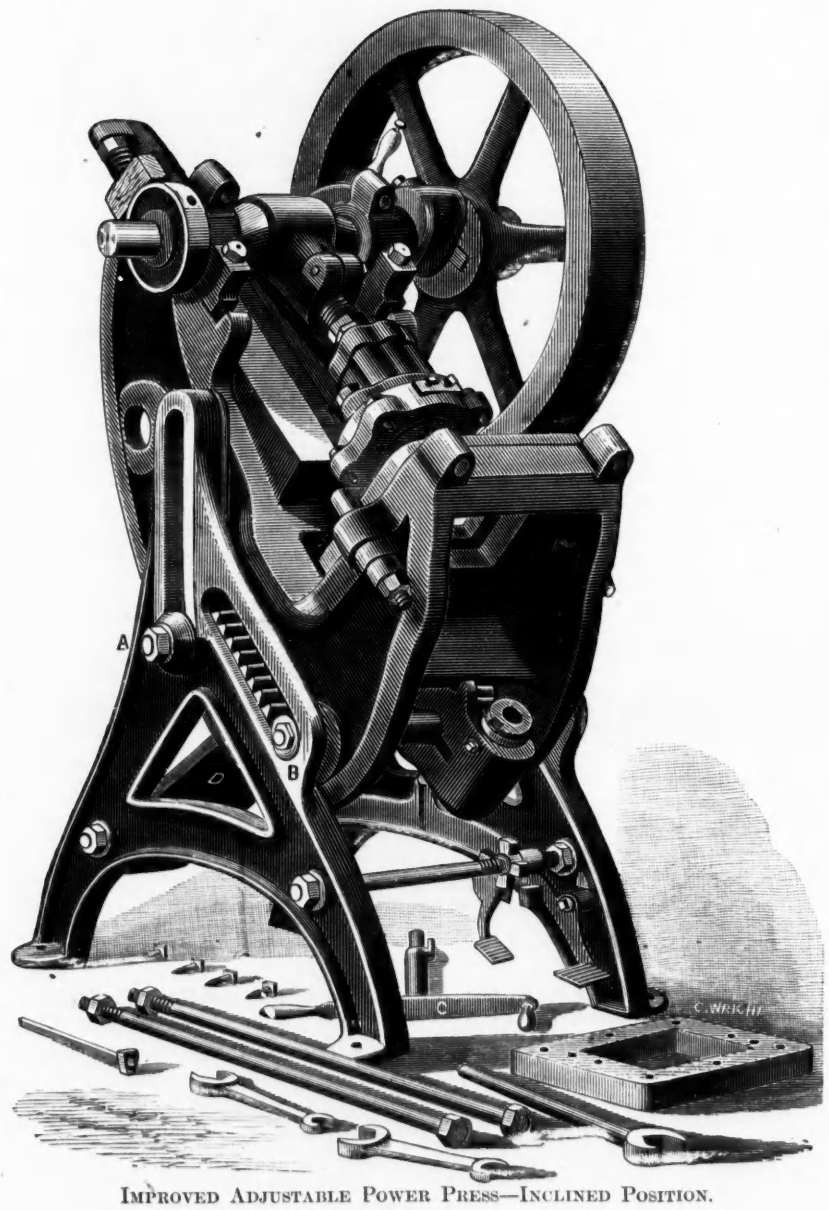
The engine being designed and sold to work at 100 horse power, it may be fairly presumed to have sufficient fly wheel for good regulation under that load. If the load is increased 50 per cent., the fly wheel will be insufficient for good regulation. Before adopting this plan, then, it will be necessary to consider the effect of further irregularity of motion.

This may be a matter of little consequence, or it may be even the chief economic consideration. Again, in many automatic cut off engines the cut off necessary to develop this power approximates so nearly the limit of the valve gear as to leave a wholly insufficient margin for good regulation. For instance, supposing the engine to work at 100 horse power, cutting off at one-fifth stroke, then 150 horse power would require a cut off at about $\frac{1}{3}$ stroke, which is nearly, or quite, the limit of some classes of engines, especially if allowance is made for variation in steam pressure.

To insure good regulation, particularly under considerable fluctuations of load, requires a considerable margin of power, over which the governor has control. While this plan may be adopted in some instances, in others it may be readily seen that the conditions would preclude its adoption. Another plan that may be considered is: Increase the boiler pressure sufficiently to keep the cut-off practically, as it is. This would bring into account the question of the ability of the several parts of the engine to withstand the strains due to the increased pressure, as well as the probable behavior of wearing surfaces under the increased friction, and particularly the condition of the boiler with reference to the increased pressure. The valves may be all right under the lower pressure, and all wrong under the higher pressure. In fact, the engine and boilers may be properly designed and constructed for the lower pressure, and fail entirely under the higher. The regulation will not be equal to that which will result from the adoption of the previous plan. In the majority of instances, the ordinary stationary boilers in use are not constructed for a pressure of from 115 to 120 pounds (which would be required), so that this consideration alone will generally condemn this plan. Where, however, none of these objections exist, it may be adopted with the expectation of increased economy in the use of fuel.

A third plan is: Increase the piston speed, preserving, as near as may be, the other conditions intact. This plan would require a consideration of the general fitness of the engine to be run at the required speed. If a high speed engine, there may be quite revolutions enough already, and if a low speed, the question of its construction for so great a change will need to be carefully considered. The dimensions of steam and exhaust ports require particular attention, since they may be only sufficient—perhaps too small—for present speed. In the majority of instances, the general economy—such as breakage of parts and the consequent delays—would be poor, 50 per cent. being ordinarily too great a change to make in the speed of any engine. When, however, it can be unobjectionably employed, the regulation should be materially improved, and the coal economy not materially changed. The fourth plan is: Make a compromise and change two or more of the conditions; this is the one that should be generally adopted. It calls for no radical change in any direction. A little later cut off in the majority of instances means better economy. An increase of the boiler pressure tends to the same result, while a little more piston speed is generally unobjectionable.

Commonly speaking, with a good basis to work from— that is, with a well-constructed engine, rated as steam engines are ordinarily rated—there should be no serious difficulty in increasing the load 50 per cent., if the matter is judiciously considered. Failures to do this, when they occur, are usually due to a one idea consideration of the subject.




IMPROVED ADJUSTABLE POWER PRESS—INCLINED POSITION.

General patent laws have, for the first time, been passed in Turkey and Liberia. That of the former is a copy in substance of the French and German systems.

The demagogues who regularly assert that a workingman has no rights which employers feel bound to respect have recently been given something which should tone their utterances in the decision of Judge Durfee at Providence. An operative in a flax manufacturing company, upon entering its service, signed an agreement to give two weeks' notice of his desire to quit the service of the company at any time, or, in default of this two weeks' notice, to forfeit two weeks' pay. He asked for leave of absence for a certain day, and, on its being refused, he remained away without leave. On his return to work on the next succeeding day, he was told that there was no more work for him, and, on demanding his pay for work done, two weeks' wages were deducted, under the forfeiture. He then brought suit and recovered judgment for the full amount earned. The company appealed, and the Supreme Court affirmed judgment, arguing that quitting the service meant the abandonment of it, not a temporary absence. "It is urged," the court concluded, "that scarcely less mischief would result from such an intermission of service than from its total abandonment. That may be so, but, in order to remedy the evil, we cannot give the contract a strained and unnatural construction."—*Boston Commercial Bulletin.*

It will cost $36 for an excursion ticket from New York to and from the International Cotton Exposition at Atlanta during its continuance, October, November and December.

The doubts which were entertained about the safety of the St. Gothard Tunnel, owing to the difficulties experienced with the quicksand-like strata found under Andermat, have at last been settled, it is believed—for the effects of time have yet to be experienced. At any rate, three layers of granite rings have been inserted; and, as they remain intact, there is reason to hope that the difficulty has been overcome, and that the tunnel will be opened for traffic in October.—*Inventors' Record and Industrial Guardian.*

The Great Eastern, the largest vessel ever built, is to be sold at auction at Milford, October 19th, by a firm of Admiralty brokers. She is 679 feet long, 82 feet broad, and 60 feet deep, and of 13,337 tons net register. The only service of importance she ever performed was in the laying of the Atlantic cable in 1865.

The British war vessel "Imperieuse," to be built at Portsmouth, it is said "will not resemble any vessel afloat." The cost of her hull alone is to be £325,000. Her length is to be 315 feet, with a beam of 61 feet. The guns will be 18-ton breech loaders, with a "disappearance arrangement." Engines are to be 8,000 H. P. If she ever comes into action, and encounters one of Capt. Ericsson's torpedo vessels, of the kind we illustrated and described in issue of Sept. 24, the "disappearance arrangement" will be suddenly and alarmingly facilitated.

## Improved Adjustable Power Press.

Since the time when upright presses were considered the only proper machines for cutting and forming sheet metals, there have been various ways contrived to incline them so that work which rises in the dies could slide out by force of gravity through the back of the press. In addition to a simple system, introduced some years ago by the makers of the press illustrated, which was merely to bolt the legs to the frame in a different position, adjustable presses may be divided into three general classes. In one class the frame of the press is hung on a pivot near the front of the bed where the die rests, and is adjusted by a curved rack and gearing at the rear. This system has the advantage of keeping the bed at the same height at its front edge, whatever the angle of the press may be. A disadvantage is that the bed in this style of press does not project forward free and clear from the rest of the frame, and does not admit of modifications, such as substituting a "horn" for the bed, etc.

The next general type of adjustable presses is one in which the frame at the bottom takes the form of an arc of a circle, the

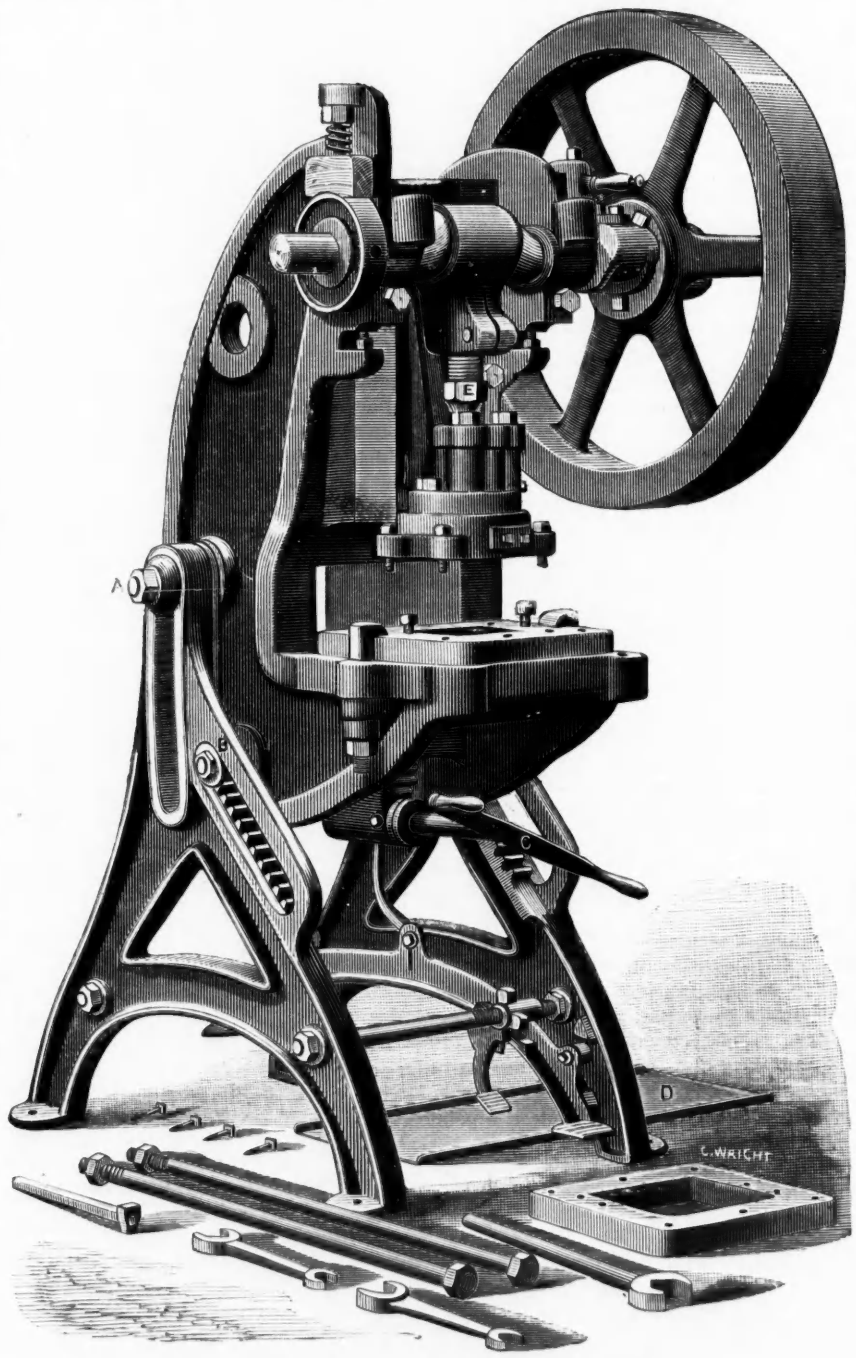
whole frame revolving in a concave cradle formed by the upper portion of the legs. Of course this is equivalent to the frame revolving on an axis, which is the center from which the aforesaid arc is described. This axis, being necessarily well back from the front of the bed where the dies are placed, the front will rise much higher when the frame is inclined than when in an upright position, thereby making the work too high to be convenient for the operator, who is consequently compelled to improvise a platform, generally consisting of an old box.

A third system, recently invented, is shown in which these disadvantages are eliminated, the front of the press being clear of projections from the legs, and supported in the middle and rear at the points *A B*. It is quickly changed from one position to the other by loosening the clamping nuts at *A B*, and revolving crank *C*, which operates a worm and gear on cross shaft, causing the pinions at *B B* to run up or down in the inclined rack. This rack, and the slot which stud *A* traverses, are placed in such a relative position that, as the angle of the press changes, the front of its bed remains the same height, yet no points move in circular arcs. The crank *C* is revolved *from the front*, which enables a number of presses to be set side by side, with space between them reduced to a minimum. A decided advantage in using a worm instead of a pinion is that it holds the press at any point, preventing accidents that might occur from its running down of itself.

The heavy ball-joint pitman is made of steel, the lower portion being spherical and fitted into a socket, which allows it the necessary angular motion as well as rotary motion for adjustment. The upper portion is screwed into a split neck on the pitman strap the distance required, and clamped therein by a pinching bolt. By means of this device the slide bar is capable of very delicate adjustment, avoiding the lost motion of right and left screws and lock-nuts, also the annoying tendency of a lock-nut to slightly revolve the rod as it is tightened "home." Another advantage of the ball-joint is the perfect *alignment* secured, should the shaft and slide wear slightly out of right angles with each other.

This press is the third of a series of four sizes, numbered 11, 12, 13 and 14, respectively, from the smallest up, and built by the Ferracute Machine Co., Bridgeton, N. J.

The accompanying cuts were engraved from photographs of No. 13 (to a scale of $\frac{1}{12}$), some of the dimensions of which are as follows: Total height, 75″; hole through bed, 7″x10″, with 8½″ intersecting circle; width of hole through back, 12″; distance back from center of slide-bar, 7″; height to do, when up, 7½″; stroke and adjustment of do., each 1½″; fly wheel, 31½″x5″; the weight of the wheel is about 370 lbs., and of the whole press, 1,950 lbs.




Improved Adjustable Power Press—Upright Position.

At the Leather Exposition at Frankfort, Germany, there are exhibited more than 100 machines of American make, which are used in the shoe and leather business. There are also sixteen men engaged in making shoes by machinery, the shafting, belting, etc., as well as the stock used in making the shoes, being from this country.

## Artificial Ventilation of Industrial Establishments.

The enforced stopping of a number of large iron works upon the occasion of the recent extremely hot spell, after the prostration of a large number of their workmen and the death of some of them, calls attention to how little has been done to protect this class of employes from the effect of the intense heat in which they are obliged to work. With the exception of perhaps one or two mills, absolutely nothing has been done in this direction. Iron workers as a class are prematurely aged, not so much from hard work as from the almost constant extremes of temperature to which they are subjected. It would seem that science should be able to devise simple and effective means (if it is not already done), and that proprietors would willingly go to the expense of their introduction, whereby the temperature of such establishments would be materially reduced during the summer months. Such a course would not benefit workmen alone, since there is always a material loss to the owners, incident to stopping work for three or four days.

What is true of iron working establishments is also true in a greater or less degree of other industrial concerns. It is not uncommon, especially in our large cities, to see hundreds of men, and worse even than that, women and children at work in hot, illy ventilated rooms, when at the cost of a few dollars, which would be returned fourfold in the increased quality and quantity of their production, artificial ventilation might be secured. It would be interesting in this respect if the mortality statistics of operatives in different industries determined how much of the large rates in some of them were due to the pursuits themselves, and how much to the lack of a ventilation that could be readily and cheaply supplied.

We feel confident that this subject will some time receive the attention it deserves, and that when it does the pursuit of individuals will not have so much to do with the age to which they will live as at present.

We learn from some of our English exchanges that a royal commission has been appointed "to inquire into the instruction of the industrial classes of certain foreign countries in technical and other subjects, for the purpose of comparison with that of the corresponding classes in this country; and into the influence of such instruction on manufacturing and other industries at home and abroad."

## Screw Cutting on the Engine Lathe.

No. 3.

By Frank H. Richards.

Having compound gears on the lathe (for instance, as they were in ancient times employed for feeding—a practice properly becoming obsolete), we wish to find what thread they will cut. Make the two drivers the first term of a proportion, the two driven gears the second term, and the pitch of the leading screw the third. I give an instance, for variety changing the pitch of the lead screw:

$$\binom{24}{40} : \binom{90}{48} :: 6 : 27$$

It will often happen that, after having computed the compound gears for some desired thread, we are unable to use them, because their sizes or relative positions will not allow of their being connected; and it will sometimes help us out of our trouble if we understand what changes may be made in either the dimensions or arrangement of the gears without impairing the result. If we have a proportion such as that which occurred in my last paper:

$$4 : 36 :: \binom{20}{24} : \binom{60}{72}$$

it obviously makes no difference in the arithmetical result if we change the relative positions of either or both pairs of gears within their own braces. The result will be precisely the same if they stand like this:

$$4 : 36 :: \binom{24}{20} : \binom{72}{60}$$

So, also, upon the lathe the two drivers may change places with each other, or the two driven gears may do the same, without affecting the motion of the screw. If any of the gears are either too large or too small to connect comfortably in the train, we may take either of the drivers with either of the driven gears, and substitute for them any other pair of gears which bear to each other the same ratio. Thus 24 and 72 are as 1 is to 3; we substitute for them 32 and 96, without changing the result:

$$4 : 36 :: \binom{20}{32} : \binom{60}{96}$$

Compound gears are of more value, perhaps, in producing minute differences of threads than in cutting the extremely coarse or fine ones. Say that we want to cut a screw to be used as a pattern for casting, allowing the usual shrinkage, ⅛″ to the foot. Just here it will save us some time if we know what we cannot do, as well as what we can do with compound gears:

$$12'' : 12\tfrac{1}{8}'' :: 96 : 97$$

This ratio—96 to 97—must appear in our train of gears; and, as 97 is a prime number, no possible combination of the usual gears on a lathe with a screw of standard pitch will produce the precise result, however near it may be approximated. To cut a screw 4 to the inch by the shrink rule on a lathe with a lead screw of 5 to the inch:

$$97 : 96 :: 4 : 3\frac{93}{97}$$

This gives us the number of threads to the inch required. Then, if we have gears 96 and 97 representing the difference between the standard and shrink rules, the computation of the other two gears is simple enough:

$$5 : 3\frac{93}{97} :: \binom{97}{50} : \binom{96}{40}$$

Screws of metrical pitch may usually be cut without special gears. If we call the length of the meter 3 feet 3 inches and 3-eighths, which is easy to remember, and within a two-hundredth of an inch of the truth, then the meter is to 40 inches, or the centimeter is to .4 of an inch as 63 to 64. We may, by way of illustration, treat this by a slightly different process. Thus .4 of an inch pitch is 2½ threads to the inch; then, bearing in mind that the number of threads to the inch is inversely as the pitch, we multiply the ratio 63 : 64 into the ratio of the leading screw to 2½. $5 : 2\frac{1}{2} = 2 : 1$. Then we have $63 \times 2 : 64 \times 1$. We multiply both terms by any factor large enough to give us gears of suitable size, say 12. Then $63 \times 2 \times 12 : 64 \times 1 \times 12$, and grouping the factors in these terms as will best suit our convenience, and multiplying we get $\binom{42}{36} : \binom{24}{32}$, which represent very common gears.

### Screw-cutting Tables.

I think it scarcely practicable to prepare a table of screw-cutting gears of any value for general use, and an examination of published tables tends to confirm my opinion. A table of the combinations of which the gears of the individual lathe are capable, with the threads which they will cut, will be found convenient. Any workman, if expert at figures, could prepare such a table very readily; and if not so expert it would afford him excellent practice. The table given herewith is given rather by way of example than for its own value, though complete and satisfactory for the lathe for which it is computed. It shows all the combinations of which the set of gears is capable, with the thread which each will cut. The lead screw is 5 to the inch. In the left-hand column are the gears on the stud, and in the upper row the gears on the screw. Opposite each is the number of threads to the inch to two places of decimals. At the lower left-hand corner is the coarsest thread that can be cut; at the upper right-hand corner is the finest thread. Most of the regular threads lie in the rows opposite 25 and 50 on the stud. The fractional threads, which are numerically nearest each other, range diagonally across the table. It will be noticed that the number of whole threads is quite large for the number of gears employed.

From this table the various threads may be selected and arranged in the order of their magnitude, whereby they may be more readily found, thus:

| | |
|---|---|
| 0.96 , 130 , 25 | 1.2 , 125 , 30 |
| 1. , 125 , 25 | 1.25 , 100 , 25 |
| 1.13 , 110 , 25 | etc., etc., etc. |
| 1.15 , 130 , 30 | |

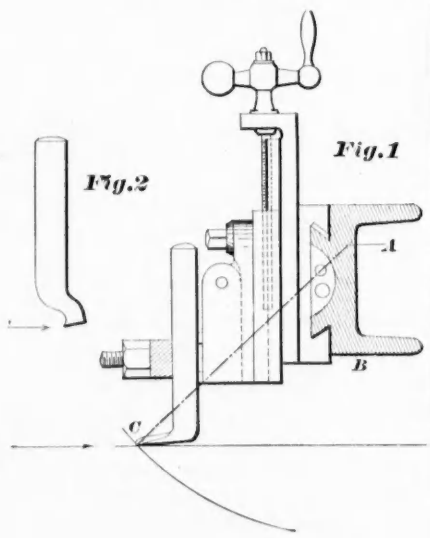
To prepare a table giving all the combinations of which these gears are capable, when compounded, would be a work of unspeakable toil, and of little practical value. These 12 gears would admit of about 20,000 changes, and would cut from 135.2 threads to the inch to 0.185.

Table for Screw Cutting.

| Gear on Stud. | Gear on the Screw. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25 | 30 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 125 | 130 |
| 25 | 0 | 6 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 25 | 26 |
| 30 | 4.16 | 0 | 8.33 | 10 | 11.66 | 13.33 | 15 | 16.66 | 18.33 | 20.83 | 21.66 |
| 50 | 2.5 | 3 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12.5 | 13 |
| 60 | 2.08 | 2.5 | 4.16 | 0 | 5.83 | 6.66 | 7.5 | 8.33 | 9.16 | 10.41 | 10.83 |
| 70 | 1.79 | 2.14 | 3.57 | 4.28 | 0 | 5.71 | 6.42 | 7.14 | 7.85 | 8.92 | 9.28 |
| 80 | 1.58 | 1.87 | 3.12 | 3.75 | 4.37 | 0 | 5.62 | 6.25 | 6.87 | 7.81 | 8.12 |
| 90 | 1.38 | 1.66 | 2.77 | 3.33 | 3.88 | 4.44 | 0 | 5.55 | 6.11 | 6.94 | 7.22 |
| 100 | 1.25 | 1.5 | 2.5 | 3 | 3.5 | 4 | 4.5 | 0 | 5.5 | 6.25 | 6.5 |
| 110 | 1 13 | 1.36 | 2.27 | 2.72 | 3.18 | 3.63 | 4.09 | 4.54 | 0 | 5.68 | 5.90 |
| 125 | 1 | 1.2 | 2 | 2.4 | 2.8 | 3.2 | 3.6 | 4 | 4.4 | 0 | 5.2 |
| 130 | .96 | 1.15 | 1.92 | 2.3 | 2.69 | 3.07 | 3.46 | 3.84 | 4.23 | 4.8 | 0 |

In our article on the Westinghouse high speed steam engine, which appeared in our issue of October 1, 1881, in regard to the floor space occupied by the engine, together with the height of the same, we published the figures furnished us by the manufacturers. We stated that an engine to develop 40 actual horse power occupies a floor space of 22″x36″, including fly wheel, and stands 40″ high over all. It should read 20 horse power, instead of 40, while for an engine to develop 40 horse power, the floor space occupied would be 42″x60″, and stands 56″ high over all. The set of cards published with the article referred to were taken with the Tabor indicator.

The Argentine Republic has postponed the opening of the industrial exhibition at Buenos Ayres until the 15th of February, 1882. It is open to machinery from all nations, but other goods are restricted to products of the country itself.




## LETTERS FROM PRACTICAL MEN.

### Tools for Planers.

*Editor American Machinist:*

Next to the modern lathe, it may safely be assumed that the planer—for metal—has reached the greatest degree of perfection of tools for metal workings.

There are, however, some serious faults in the best of planers, that should engage the attention of tool makers in the future.

Much has been said and written about the proper shape for lathe and planer tools, and so far as angle of cutting edge, position of rake, formation of shank and speed of work are concerned, we have definite and exhaustive treatises of able writers. But touching the principles involved in the construction of planers, very little has been said.

In my experience I have as often found reason for blaming the planers as the tools for unsatisfactory action, and have come to the conclusion that even a Whitworth tool is but an expedient to modify the improper performance of the beam and its fittings.

In the cut, *B* indicates a vertical central section of the beam. The arrow shows the direction of thrust when the tool is cutting, and the radius, *A C*—center at *A*—shows the action of the tool when the strain is sufficient to cause a springing of the beam. Variations in design of beam may change the position of the center *A*, but no form at present made will have it far from where shown. Some years ago I was made to understand this case, and was compelled to seek a temporary remedy. I had undertaken to plane up a complicated moulding on a piece of tool steel, and had constructed a tool for taking the finishing cut at one operation. The width across the tool was about 1″, but measured on the different curves the face was nearly 2.″ The shape of the tool was as shown in Fig. 2, and I set it as short as possible (bringing the beam within ¼″ of the work).

Well, like Mark Twain's man who ate tamarinds, I only did it once.

The tool was made with great care, and I was reluctant to charge it with the failure.

I concluded that the planer had a congenital weakness, and that my only hope was in making the tool *still weaker* than the machine.

Happily, the shank of the tool was nearly 12″ long. I forthwith raised the beam as high as the tool would allow, and tried again. This time with most excellent—surprising—success. I took numerous cuts off the full width of the tool without the slightest jar or chattering.

Since then I have always made it a point to have the tool weak enough to do nearly all the springing when making heavy cuts. I mean heavy wide finishing cuts.

The tool in Fig. 1 is of bad shape, but I hold that in working the planer heavily, the tool does but a small portion of the mischief, and that the chief reason for the satisfactory performance of the Whitworth tool is that its very shape makes it weaker than the beam.

Great efforts were made some years ago to make planers cut both ways, but, to the best of my knowledge, without success. It proved to be impossible to make the tools cut alike in both directions. A glance at the cut will at once tell why.

The future planer will, among other things, have the center of vibration vertically over *C*. When may we look for such a tool, and who will design it?

C. C. Hill.

Blackfoot, Idaho Ter.

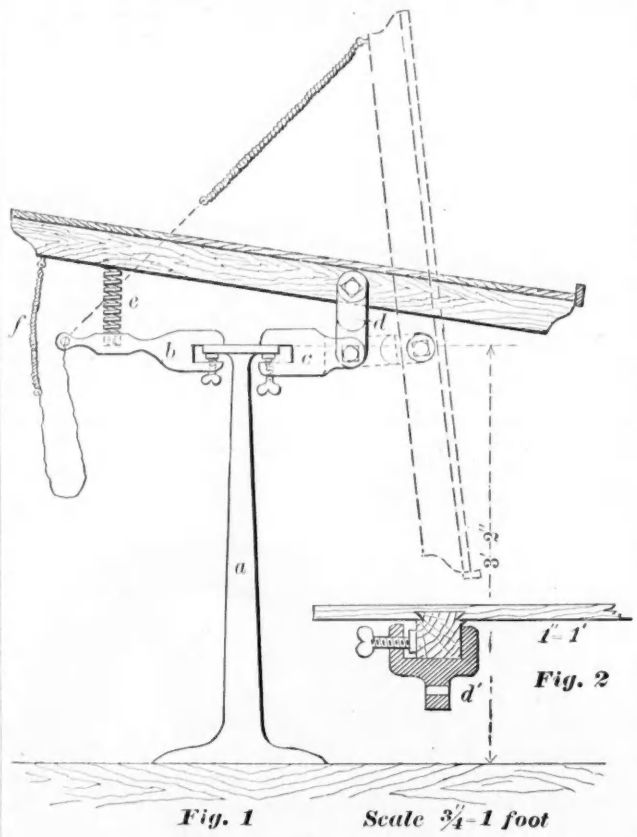



*Fig. 1* *Scale ¾″-1 foot*

A Movable-Drawing Board.

### A Movable Drawing Board.

*Editor Am. Machinist:*

I send you a sketch of a good movable drawing board, which should be in every draughting room, for the health, comfort and convenience of those using it; as its cost is trifling, and it will pay for itself in a short time, as you can work more rapidly.

It consists of two cast iron stands *a*, which are placed apart to suit battens on the bottom of the board (according to size, board 7 feet wide, and stands 5 feet 8 inches from center to center, is a very good size); one brass casting *b*, which is fastened on the round top of the stand, nearest the top, on which there is a spiral spring *e*, and also a piece of wire fastened to a smaller spring *f*, which is secured to batten by a thumb screw, preventing the board from falling when it is in its horizontal position (as dotted lines show); two (2) brass castings *c*, which are fastened to *a* on the end nearest the lower portion of the board *d*, which clamps the batten of the board and imparts the motion to it, is held to *c* by means of a movable pin. The section above the board shows how *d* is fastened to the batten.

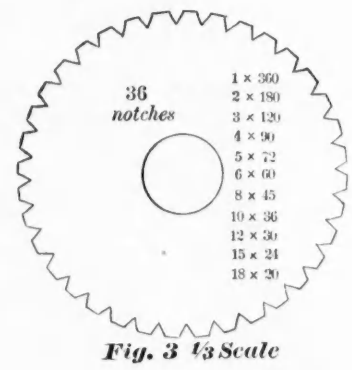



*Fig. 3 ⅓ Scale*

As the cost of construction is very low, I hope my fellow draughtsmen will not suffer any more by the disagreeable positions that a stationary board often places them in.

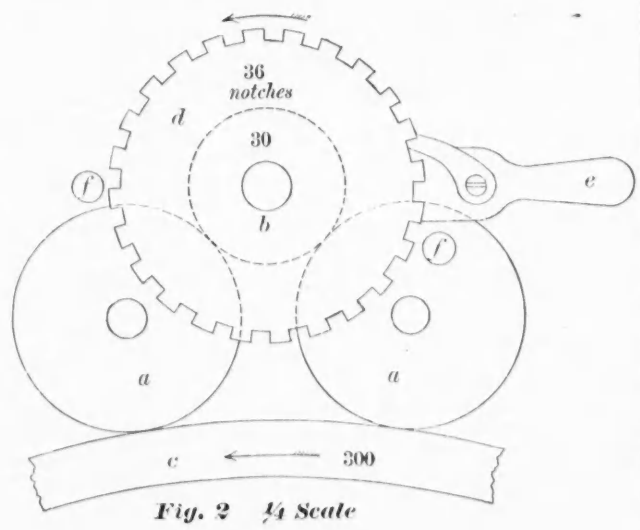



*Fig. 2 ¼ Scale*

Any one desiring details may inform me, and I will furnish him with them.

M. Otto Bellingrodt,
Draughting Room, B. & O. R. R.,
Baltimore, Md.

### Dividing the Circle.

*Editor American Machinist:*

In the American Machinist of Aug. 27, a correspondent explains a familiar and accurate method of dividing the circle into equal parts. Some ten years ago a gear cutting machine was constructed upon the differential gear principle, the teeth of the main gear of which were produced by essentially the same method. Some of the chief features of that machine were illustrated in one of the scientific journals at that time. Since then some refinements have been suggested in the construction of this class of machinery, which may be new and of interest to some portion of the mechanical fraternity. One of these refinements consists in applying two equal intermediate pinions, shown at *a*, Fig. 2, of the accompanying engravings, between the working pinion *b* (indicated by the dotted circle) and the main gear *c*. The number of teeth in these intermediates is arbitrary, but the number of teeth in the main gear *c* must be a multiple of the number in the pinion *b*, of course. The advantage of this three pinion arrangement is that it doubles the points of contact of the gears and their wearing surface, and thus insures greater precision and durability. Another refinement consists in making the teeth much shallower and more numerous than is customary in ordinary gear work, so that their operation shall approach, as nearly as possible, that of a simple rolling contact. Dividing machines of this class are operated with great facility, and are capable of wide range of application. For instance, if the main gear *c* contains 300 teeth, all of the numbers of which 300 is a multiple, viz.: 150—100—75—60—50—30—25—20—15—12—10, may be cut, of course, without the pinion; but in order to produce other numbers, the differential agency of the pinion *b* and ratchet wheel *d*, is necessary. The ratchet must be fixed to the pinion, of course, so as to turn with it without any slip, and so that it may be easily changed. The pawl handle *e* works between two stops *f*, one of which is adjustable to limit the movement of the pawl to the exact number of notches to be taken for each tooth to be cut.

The amount of movement which must be given to cut any desired number of teeth, is always expressed by a fraction whose numerator is the number of turns or revolutions the pinion *b* makes to one revolution of the main gear *c*, and whose denominator is the number of teeth desired. In the arrangement shown in Fig. 2, the pinion of 30 teeth gives us a numerator of 10, because 300 contains 30 ten times. Gear cutters are often arranged in the proportion of 12 to 1. Now, if we would produce a pinion of 21 teeth, for instance, with the arrangement shown in Fig. 2, the amount of motion of the ratchet wheel *d*, for each tooth, is represented by the fraction $\frac{10}{210}$, or its equivalent $\frac{20}{420}$, $\frac{40}{84}$, and so on; hence if the ratchet wheel *d* contains 84 notches, a movement of 40 notches for each tooth cut will produce a pinion of 21 teeth; or if we would divide a circle into degrees, the amount of movement is expressed by the fraction $\frac{10}{360}$, or its equivalents, $\frac{1}{36}$, $\frac{2}{72}$, etc.; hence if the ratchet wheel contains 36 or 72 notches, a movement of one or two notches respectively for each division will produce 360 degrees.

In order to ascertain what numbers any ratchet wheel will produce, multiply its number of teeth by 10, and the product is a multiple of such numbers. Hence, the ratchet wheel represented in Fig. 2, with 36 notches, will produce $1\times360$ $2\times180$—$3\times120$—$4\times90$—$5\times72$—$6\times60$—$8\times45$—$9\times40$—$10\times36$—$12\times30$—$15\times24$—$18\times20$—etc.

Each ratchet wheel has its peculiar set of numbers stamped upon its face, as shown on Fig. 3, indicating that a movement of 18 notches will produce 20 teeth, and that a movement of 20 notches will produce 18 teeth; and that a movement of 24 notches will produce 15 teeth, and that a movement of 15 notches will produce 24 teeth; and so on, reciprocally; and that a movement one notch will produce 360 degrees, or teeth, etc., and the figures to be stamped on the ratchet wheel of 84 notches will stand thus: $1\times840$, $2\times420$, $3\times280$, $4\times210$, $5\times168$, $6\times140$, $7\times120$, $8\times105$, $10\times84$, $12\times70$, $14\times60$, $15\times56$, $20\times42$, $21\times40$, $24\times35$, $28\times30$. It will be observed that but very few of these numbers correspond with those on the wheel

of 36 notches, hence it requires but few changes of these wheels to produce a great variety of numbers. F. G. Woodward.

Worcester, Mass.

### Drawing Boards.

*Editor American Machinist:*

In the matter of drawing boards I am going to give up in disgust, and come right down to seasoned inch pine, dressed one side, edges trued and planed, and cleats screwed on below. I found these just as good for tables 10×4 feet as two-inch stuff, glue-jointed and doweled. The ends should be trued and filled with shellac to prevent checking.

As regards truing up, it is an expensive and troublesome affair to make all four sides and both faces true, and don't last. The best way is to get one side dead true, mark it, and always work from that, using the same square and big triangle always in the same relative positions.

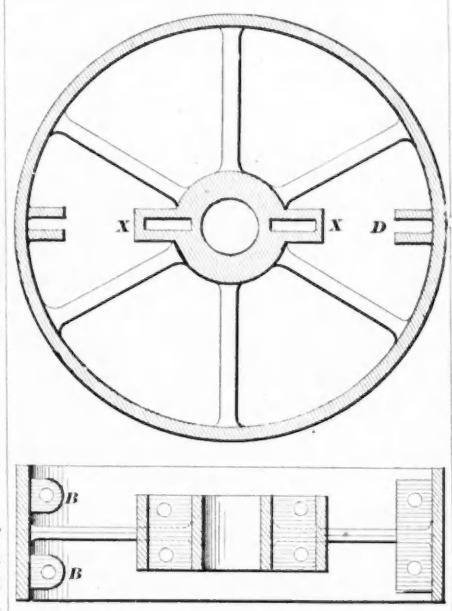
It will be found a convenience to set small boards on an ordinary office stool, which permits of sitting at work, and allows the board to be turned, as well as giving adjustable light. Then visitors don't lean on it. I now use sharp copper tacks in place of fancy thumb tacks; points don't come out or punch through. R. Grimshaw.

Philadelphia, Pa.

### Splitting Pulleys and Other Castings.

By Thos. D. West.

It is often necessary to cast pulleys, gear wheels, fly wheels, etc., whole, and split them in halves after casting, for convenience in handling, or fastening to a shaft. The splitting of such castings has not always been a success, from the effects of which both moulders and machinists have been annoyed. There are several ways of splitting such castings, and what would be good for one style, would not do for another. I have seen wrought iron plates set in the mould to split heavy and light castings, and although the plates were painted with blacking, coal tar, oil or rosin, the iron would eat into them, so that in trying to split the casting it would be broken, or it would take much time and labor to split it. A plan that I found to work successfully for such castings, was to use two plates instead of one, and if it is preferable to have the plates stick to the casting, so that in fitting together it will not be necessary to handle loose plates, it would be better not to paint them at all. If it is thought the iron will not adhere to the plates, holes may be drilled nearly through them from the sides against which the iron will run; or the holes may be drilled quite through, if care is taken that they do not come opposite each other in the two plates. This plan will make a sure thing of splitting a casting, without any trouble, and when the casting is placed together again, it will be the same circle or shape that it was before it was divided, and without any fitting on the part of the machinist. For each class of work cast iron plates, made the required shape and size, might be preferred, as the iron will adhere to them better, and be less liable to show the joint. There are moulds in which the double plates cannot be made to stand up together. In such cases the two plates may be fastened together with two small rivets near their ends, so that they can be easily opened. The accompanying cut represents the plan and elevation of a split pulley, and shows a good way of using cores for splitting a casting, so that when put together there will be no fitting required. There are very few jobs that the foundry man dislikes more than splitting pulleys from whole patterns. Whether they are made from a draw or a split pattern makes very little difference. Not many years back it was thought a great favor to get a pulley cast in halves. Now-a-days they are ordered the same as other castings, and, as a rule, they are expected at the same price as plain pulleys, although it takes twice as long to make them. I have said to parties, "I can show you some nice split patterns, just the size you want every way," and their answer would be, "O, I guess you had better make them from the whole pattern, and split them; as it will save me time in planing and fitting." Of course the result would be they must be made as wanted, or the custom of the parties lost to the foundry. Having split pulleys in almost every way, I think the plan, as herewith shown, to be the best. The hub of the pulley shows a lug *X X*, on each side. A core from ¼″ to ⅜″ thick cuts through the top and bottom. The iron at the edges of the core should be of a thickness to crack open easily, and still have bearing enough to hold the joints strong when bolted together to be turned and bored out. There are two styles of lugs or ears shown on the rim for bolting the halves together.




The round separate lugs *B B*, are made in a core box, and when ramming up the pulley set the dry sand lug core against the pattern, and ram them up. The opposite lug is made with a piece of pattern with core print on the bottom, to set in the long, flat core, as shown at *D*. This latter form of lug is best for large and heavy pulleys. In splitting these pulleys the job is generally left to the machinist, and I think the best plan is to split them open before boring or turning, as the chisel marks can then be all turned out, and a truer pulley made than by splitting after finishing.

### Shop Kinks.

No. 18.

By L. F. Lyne.

PECULIAR BELT TRANSMISSION.

Upon an inspection of Fig. 1 in my article in the American Machinist of Sept. 17, 1881, the reader will observe a lathe marked *x* in the room *F*. This lathe is for turning wood, and stands in front of a window, which seemed to be the only location for it where it would be out of the way. The problem was how to drive the lathe, standing as it does at right angles to the shaft, marked 24, from which the power was to be taken. Several plans were proposed, which were abandoned after due consideration, and the attempt to drive the lathe in that position was declared to be impracticable.

The writer designed and put up the transmission here illustrated, which has now been in use about six years with no alterations or complaints.

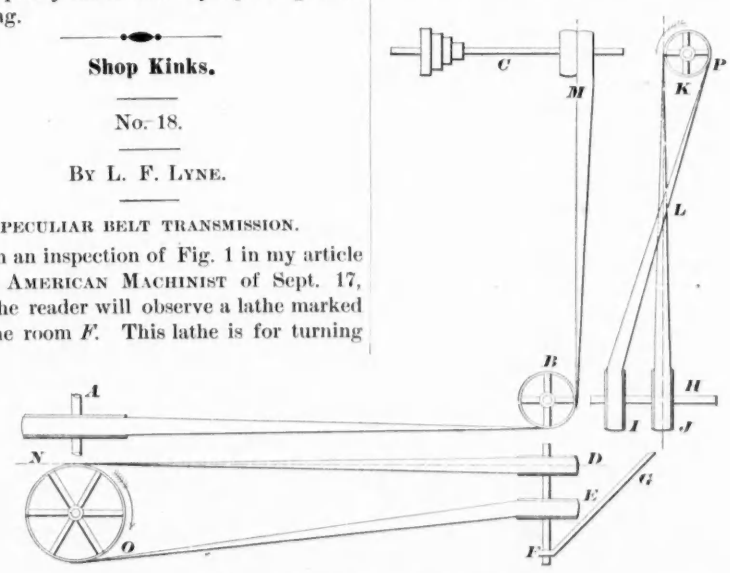
In Fig. 1 of the paper mentioned, the reader will observe a pulley *y*, upon the main shaft, from which a belt extends around two mule pulleys *z*, and, turning a right angle, connects with the counter shaft of the lathe *x*.

To make this transmission of practical value to the young mechanic, I have made a detail drawing of the same, which is shown in the accompanying engraving. *A* represents the pulley upon the shaft referred to, from which power is to be taken. This pulley revolves in the direction shown by the arrow, while the countershaft *C*, of the lathe turns in the opposite direction.

It is a very easy matter to put up an open belt connecting two shafts at right angles to each other in the same plane; but where the belt is to be crossed it involves a more difficult piece of work. To locate the pulleys stretch a line *N D*, level through the center of the face upon the pulley *A*, fastening each end of the line to strips of wood nailed to any convenient timbers. The lathe is supposed to have been already set, and the countershaft up. A second line *M*, is drawn through the division line between the faces of the tight and loose pulleys upon the countershaft of the lathe. The vertical shaft *F*, may now be put up, so that the face of the pulley *B*, will just touch both lines. Care must be taken to place this shaft plumb, and securely hold it in that position by two braces *G*, of half-inch round iron, one to take the strain of the belt each way.

After the vertical shaft *F*, has been secured in position, the pulley *I*, is to be raised so that the line *N D*, will touch the center of the face; the collar upon the shaft should then be tightened to hold it in that position. A line is then to be drawn level from the top of the pulley *K*, upon the countershaft, and the pulley *J*, raised so that its center will be at the same height as the line. The collar should then be tightened to hold it in position.

To those who do not understand mechanical drawing, I would say that *F* and *H* are the two different elevations or views of the pulleys and shaft *B*, to show the arrangement more intelligently. After the pulleys are secured, put on the belt and see how it will run. By turning the pulley *A*, in the direction indicated by the arrow, the belt travels in a direct level line to the pulley *D*, where it is twisted at a right angle and also turns a right angle. It then takes a downward course from *I*, and being twisted again at a right angle, passes under the pulley *K* at *P*. Following the direction of the arrow, it travels from *K*, in a direct level line to the pulley *J*, crossing the other part of the belt at *L*. It is then twisted at right angles, and leaving the pulley at *E*, takes a downward course to the main pulley at *O*. I think this explanation will be sufficiently explicit to enable those for whom it is intended to understand.




Peculiar Belt Transmission.

In this case the shafting, pulleys and lathe were placed, and when the belt was put on there were no adjustments made or necessary. A workman should think first of what he is going to do, and thoroughly understand the job before commencing. It is customary with a great many workmen to put up shafting partly by guess, then put on the belts and adjust the shafting so they will run. This is an expensive way to work, for frequently, if the belting is not of the best quality, it will stretch unequally upon the edges, which will cause it to run to one side of the pulleys. I remember a case where the belt ran over the edge of a pulley, and the superintendent was very certain the shafts were not parallel. When a measurement was taken they were found to be right. The belt was taken off and laid out upon the floor, where it resembled a great snake. At some places the edge of the belt was stretched 4″ from a straight line. A new belt was put on, which ran all right; so the manner in which belts frequently run are not always proofs that the shafts are not parallel.

In the case here illustrated certain conditions are required. The pulleys *D E*, must be high faced or well crowned, likewise the pulleys upon the lathe countershaft. The belt not only reverses the motion, but has to be shifted from the loose to the tight pulley, and vice versa, in starting and stopping the lathe; therefore the distance from *P* to *H* should not be less than from eight to ten feet to enable the belt to run freely upon either the tight or loose pulleys. Shafting should and can always be put up so that there shall be no alterations made after the belts are in place. I once fitted up a shop where not even a nut was tightened or loosened for six years after the belts were put on. My next will be a kink in counter shafting.

### The History of the Screw Propeller.

The erection of a monument to Sauvage, who is believed to be the first to have practically applied the screw propeller to the driving of ships, has given rise in France to a discussion of the true history of the propeller, and the interesting fact has been elicited that it was actually applied on a small scale by Leonardo da Vinci about the end of the fifteenth century. That great artist and engineer endeavored all his life to find a means of flying; and though his admirable studies on the flight of birds are well known, few are aware that he invented several apparatus for elevating man above the ground and wafting him through the atmosphere. All these solutions of the aërial problem are independent of the principle of levitation, and aim at realizing flight by apparatus heavier than the air. Amongst these numerous plans, which can be seen in the *Codice Atlantico* deposited in the Ambrosian Library of Milan, and also in the volumes belonging to the library of the Institute at Paris, there is the design of a large screw destined to turn round a vertical axis, beside and below which are written some notes in Italian, to the effect that the thread of the screw should be of iron wire stiffened with light supports, and covered with linen cloth having its pores stopped with gum. According to the author, when this screw is rapidly turned, it mounts into the air. The design is a very rough one, but it is perfectly clear, as may be seen at page 401 of the *Comptes Rendus* for August 29th. We see, therefore, that Leonardo da Vinci in all probability invented the screw propeller, and first applied it to aërial locomotion, thereby anticipating M. Tissandier in his recent application of the same device to a balloon by means of stored electricity. The latter employs bamboo for the framework of his screw, and curiously enough the Italian philosopher also suggests the use of long stout reeds. Moreover, on consulting the *Saggio delle Opere di Leonardo da Vinci*, published at Milan in 1872, M. Govi finds that that universal genius had studied the effort exerted in striking the air with plates of a given size, and also invented the well-known parachute, of which a rough design is given, showing the figure of a man clinging to it.—*Engineering.*

A light without heat is a recent invention of Dr. Michael, of Hamburg. Phosphorescent matter in a vacuum is rendered luminous by being electrified from a Ruhmkorff induction coil, the intensity of the light being regulated by the strength of the current. It is believed the light will be useful in surgery, where the heat from other lights is objectionable.

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NEW YORK, OCTOBER 15, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

## The Next Mechanical Engineers' Meeting.

The second annual meeting of the American Society of Mechanical Engineers occurs in this city November 3rd, which is less than one month from the present time. This society is accredited as a representative body of the most advanced and progressive mechanical engineers of America, and the papers read at its regular meetings, and the discussions brought out thereby, are taken as expressions of the best modern mechanical practice. Since its foundation, about a year and a half ago, the society has grown in membership and influence beyond the most sanguine expectations of its founders. There has been no lack of papers or material for active discussion at any of its meetings, the tendency being, if anything, towards a superabundance. It is clear that with a continuance of the present rapid increase of membership, either a plan of occupying the time of its sessions largely by the presentation of short papers or memoranda, followed by brief and pointed discussions, must be adopted, or the majority of members will be excluded from the advantages which a participation in the proceedings is designed to confer. With the multitude of subjects that might properly be considered, any paper occupying the whole attention of the society for two hours should be of surpassing interest and importance.

It is hoped that the publication and distribution of the society papers will be accomplished with less delay than has heretofore been the rule.

## The Barbed Wire Fence Monopoly.

A controversy, the end of which is probably to be reached after years of expensive litigation, is going on between Western farmers, particularly those of Iowa, and the owners of the patents for barbed wire, such as is used in making fences. The force of this controversy is apparent, when it is considered that in many portions of the West a lack of timber compels the farmer to use a substitute in fencing his farm, and the barbed wire is what is almost universally used at present for that purpose. Each party to the controversy has stated the case in a communication, which appears in the *Iron Age;* the Washburn & Moen Manufacturing Co., as owners of the patents, or at least as controlling them, on their part, and C. C. Cole, of Des Moines, Iowa, as representative of the Farmers' Protective Association—a society recently organized under the laws of the State of Iowa, for the farmers.

Mr. Coles' statement is in substance that the farmers are charged at the rate of 10 cents a pound for common, and 11 cents for galvanized barbed wire, and that previous to judicial decisions sustaining the validity of several patents, it could be readily bought for 6 and 7 cents. These patents, in which the rights of the manufacturers are vested, Mr. Cole claims, are reissues, which are in every instance materially different from the original, embracing devices in actual use before such reissues, and the validity of which the society propose to contest to the end.

He says the farmers would willingly pay a royalty of three-quarters of a cent a pound, which, taking Mr. Washburn's statement, that there was sold last year in the State of Iowa alone 150,000 tons, would give the owners of the patents a clear income from one State of $2,250,000 per annum. He further says that the association stands ready to pay this royalty of three-quarters of a cent a pound, and after completing their arrangements will furnish the wire at 7 cents a pound; but that its members protest against paying (in one State) an additional sum of $9,000,000 yearly, which is the difference between the price at which they will sell it after paying what they consider a fair royalty (i. e., three-quarters of a cent a pound) and the price they have to pay for it as at present manufactured by the Washburn & Moen Manufacturing Co., or under their license.

Mr. Cole repels with some warmth the assertion that the farmers of Iowa are opposed to patent laws, or to the payment of a proper royalty to patentees, and concludes as follows: "If Washburn and Moen had been content with a legitimate royalty, and had not organized an oppressive monopoly in addition thereto, the farmers would have paid it rather than resort to litigation, although confident that the result of the litigation will demonstrate the utter invalidity of their claimed patents, and the fraud connected with their reissues."

In reference to this statement, we believe it will be generally admitted that if Mr. Cole has correctly stated the price at which this wire is sold by the Washburn & Moen Co., or by those licensed by them (and we shall have something to say further on bearing directly on this point), he has made a strong case so far as extortion goes. We don't believe there is a smart iron worker's apprentice in the East that does not know by intuition that 10 cents a pound for the barbed iron wire (ungalvanized), taking into consideration the quantity of it that is sold, is an outrageous price. If his statements are facts, we believe that any association that resists such extortion by all lawful and legitimate means is doing the whole country a service. We say this, fully believing and affirming that no man is more entitled to consideration and a generous remuneration than the inventor.

To refer to the statement of the other side: The Washburn & Moen Manufacturing Co. say, in substance, that they have worked up the business at great expense, and that the wire is furnished *to the farmer* (the italics are ours) for 8½ cents a pound, and, we quote: "Moreover, the actual difference between the cost of barb fencing and the price at which it is to-day furnished, promptly and in any quantity to the *farmers of the country*, is not to exceed 2 cents per pound."

Since they assert that it is sold at 8½ cents, it is right to assume from *their standpoint* that this is a fair price for it. Taking this to be so, it is plain, if, as Mr. Cole states, the price is 10 cents instead of 8½, that the farmers of the State of Iowa are still overcharged to the extent of $4,500,000 yearly.

It is clear that, while we may reasonably make allowances for an honest difference of opinion between the buyer and seller, as to what constitutes a fair margin, there is between the statements of the two parties a plain difference of 1½ cents in the price of a pound of wire, and that difference in Iowa alone amounts to the comfortable sum of four and one-half millions of dollars annually.

It was previously noted that occasion would be taken to again refer to the matter of price. We speak from personal knowledge when we say that the price recently asked at the office of the Washburn & Moen Manufacturing Co., in New York, for a considerable quantity of galvanized barbed wire, was 11 *cents per pound*. Further comment seems almost superfluous.

Western farmers have been accused of manifesting hostility to manufacturers—especially of patented articles—and it must be confessed that to a considerable extent the report is credited. On the other hand, the farmers assert, with too much truth, we fear, that they are made the victims of unprincipled swindlers in the patent business; and not only this, but that reputable business houses too often consider them legitimate prey.

While, as previously intimated, we maintain that the inventor, or the purchaser and holder of patents, should be amply protected in his rights, we believe that patent laws are designed to benefit the inventor *and* the people; the inventor, by such protection as will allow him to amply reward himself for his labors; and the people by affording them improved devices at reasonable prices.

Thus far it seems to us that Mr. Cole's statement in behalf of the farmers of Iowa, to the effect that they are being unjustly taxed to the extent of some millions of dollars yearly, through the working of a monopoly which controls the sale of what is to them a necessity, is unimpeached.

The article on "Cone Pulley Diameters," by Prof. J. F. Klein, on our first page this week, will pay any machinist to peruse. The subject will be concluded in one more article.

We present this week No. 3 of the series of articles on "Screw Cutting on the Engine Lathe," by Frank H. Richards. Nos. 1 and 2 of these articles appeared in our issues of August 13th and August 20th, respectively. The author makes plain what is to many machinists a puzzling subject.

## Among our Western Exchanges.

Our technical exchanges are well filled with good things for their readers, and we regret that the always crowded state of our columns will not permit us to make frequent extracts. Every one is carefully scanned in our office and they *do not* find their way into waste paper baskets.

The *American Miller* in an article on the liability of mills to dust explosions, points out that the danger from this cause is exaggerted, and that insurance companies have magnified it from selfish motives. It advises workmen to be careful, especially around bolting chests, and not to expose lights in dust rooms; "but," it continues, "there is no need of panic-fear seizing them in regard to the destructiveness of dust explosions. Most explosions are harmless, except when they take place in tight rooms. Destructive dust explosions have been exceedingly rare, when we consider the immense number of mills there are in operation."

The *Railway Age* and the *Railway Review* are both in arms against commercial travelers. It seems that the Commercial Travelers, Association has petitioned the railroad passenger agents for a reduction of their rates of fare and extra baggage charges, which reduction is opposed on the ground that, as the *Age* remarks, "they have fastened themselves as a costly incubus upon trade, which the real representatives of the mercantile interests would be only too glad to force off if they dared." We have always labored under the innocent belief that commercial travelers were very good customers for the railroads, and therefore deserving their favorable considerations. So far as the merchants are concerned, we hardly think they would, as a class, rejoice to see commercial travelers withdrawn. The fact is apparent that were it not for these indefatigable salesmen, merchants in many localities would have their shelves piled with antiquated goods, and many mills, factories and workshops would be running with appliances that might properly be ascribed to an antediluvian era. Until we have reached the acme of mechanical and commercial progress we can hardly afford to dispense with commercial travelers.

The *Industrial World* concludes an article reviewing the present industrial activity as follows:

"This is indeed a period of unexampled activity in all departments of manufacture. East or West, it matters not, the clang of hammer and the sound of steam are everywhere to be heard. The hum of industry is the music of the hour, and it is a music which should gladden the heart, for it signals the fact that prosperity and happiness abound in our land. There are many signs that indicate that this prosperity is to be permanent. The activity of trade denotes a healthy growth. Our shops and factories are turning out useful products, which are to be devoted to actual use, and not for speculative purposes. Our enlarged manufacturing is truly representative of our increase in wealth and population, and of a return of confidence in the minds of capitalists, which is, indeed, the key to our present favorable situation."

The *California Architect and Building Review* notes signs of an improvement in the building trades of San Francisco, where dullness has been prevalent. It says, however, that the number of mechanics which were once in that city has greatly diminished, but those who remain find little difficulty in obtaining employment.

The *Western Manufacturer* discusses what it calls "an unnecessary scare," viz: the retaliatory tariff British newspapers threaten to impose upon the admission of American agricultural products. It states that we export only about 10 per cent. of the surplus grain

and provision products of the country, the other 90 per cent. being sold to the manufacturing and commercial industries of this country. In years of short crops we may have but little left for export. Under English free trade policy, in case of a general failure of crops, we would be dependent upon Great Britain for three or four hundred millions of dollars' worth of manufactured goods, which under protection we produce ourselves, and we would be compelled to run in debt for the whole amount, to be paid out of the next crop, or part with our stock of gold used for currency and for conducting foreign exchanges. Whichever way the question is considered, it seems very improbable that Great Britain can scare the farmers of this country into demanding a change of tariff, alike inimical to their own interests and to those of manufacturers

The *Trade Review*, of Cleveland, says that much of the enthusiasm with which the Case School of Science, in that city, was greeted, is declining. "There is a tin plate on the residence of the late Mr. Case indicating the 'School,' and some months since a circular was issued setting down somewhat high terms for a 'course' of instruction, without any mention as to what instructors had been selected. So far it has merely the name to live. It has done nothing as yet to advance science and the arts."

The *Review* calls upon the trustees or the head of the concern, if there is one, for information as to what plan has been adopted to fulfill Mr. Case's intentions, and give some motive to sons of mechanics to enter the school. "They seem to have resolved themselves into a private coterie," it continues, "with no felt responsibility beyond announcing that the school is 'open,' and patronizing a few private teachers, so far as to hand over to them any chance scholars that may choose to come."

The *Northwestern Lumberman* reviews the organization and objects of the new Northwestern Lumbermen's Association. One of its objects is to collect statistical information. To do this work thoroughly, so as to make it of unquestionable value, is more than such an association has facilities to accomplish, and, says the journal referred to: "We have never known of one that was willing to spend the amount of money necessary for its accomplishment." But in other directions the association can do an immense amount of good. The Babelic confusion regarding grades might be done away with. "The same grade of board should have the same name in one market that it has in another, and the different markets should have the same inspection rules for determining the grade." An exchange of opinions regarding questions of prices, freights, mill managements, credits, and a hundred-and-one other subjects, may prove profitable. The social advantages of the society are not among the least. Members become acquainted, and for the time business differences are put out of sight.

The *Age of Steel* takes up "the barbed wire muss," and states that one manufacturer of barbed wire refused to take out a license under the patents, carried the case to the Supreme Court, "and has obtained a settlement on terms which are an outrage on the older licenses and a parody on justice as set forth in the season when licenses were first granted on equal terms."

The *Leffel Mechanical News* discusses the "gathering and scattering" of wealth in this country, and contends against "the social and political philosophers who predict incalculable evils to this country as the result of the accumulation of capital in the hands of wealthy individuals." As the result of conditions existing in this country, poor men get rich, "hundreds of thousands of them, every year," and as the aggregate increase of wealth is very moderate, quite a number become poor at the same time, or die and leave their riches to be scattered. This shifting and changing of wealth, like a football, is claimed to be a safeguard against the evils of its accumulation in the hands of a few individuals.

## QUESTIONS & ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.*

(1) T. H., Dordrecht, Nederland, asks: 1. What is the curvature and length of locomotive springs? *A.* Curvature from 3″ to 5″; length from center to center of hangers, about 3 feet. 2. How are they tempered? *A.* Heat to the proper temperature in a furnace, and cool in oil.

(2) A. S., Haverhill, Mass., asks: Will you please inform me if the Ohio and Kanawha Rivers are good places for a marine engineer to go for work? *A.* We can only say, in a general way, that we believe marine engineers do about the same in those localities as in others.

(3) L. C. J., Hartford, Conn., asks: 1. How is asbestos sold—by weight or measure? *A.* By weight. 2. Would limestone, or fluor spar, or any ordinary fluxes, dissolve asbestos in the presence of intense heat? *A.* Such heat as is common in industrial operations has very little effect on asbestos.

(4) J. H., New York, asks: Will you please inform a constant reader of the rule for laying out the domes for steam boilers? *A.* There is no rule in the sense in which we understand your question. You will find the method graphically explained in works on the drawing of machinery.

(5) J. P. M., Westminster, Md., asks: 1. Who can I write to at the Patent Office for information concerning patents? *A.* Address: Commissioner of Patents, Washington, D. C. 2. To find the length of iron to make a ring or pipe, I find the circumference corresponding to the given diameter, to which I add three times the thickness of the iron. My friend adds once the thickness of iron to the given diameter, calls this the diameter, and finds the corresponding circumference for the length of iron to make the ring. Which is right? *A.* Your friend.

(6) J. C. S., Hamilton, Ohio, asks: Will you please settle the following problem in Questions and Answers—A safety valve has an area of 5.41 square inches. The effective weight of lever, including the weight of valve and connection, is 65 pounds. The weight of pee is also 65 pounds. I claim that with the pee directly over the valve, the valve would be lifted by a pressure of 24 pounds per square inch; also, that the increase of pressure at which the valve will be raised, as the pee is moved out on the lever, will be 12 pounds per notch, the notches to be correctly spaced, and counting the point directly over the valve as one. The pressure necessary to raise the valve, with pee, at the fourteenth notch would be 180 pounds. Will you please tell me if I am right, and if I am wrong will you give a formula for obtaining the correct result? (Our correspondent sends a sketch of a common safety valve and lever, which he has spaced off as intimated, *beginning at the fulcrum.*) *A.* You are right.

(7) C. H. S., Philadelphia, Pa., writes: 1. The following is given in "Cadet Engineer" for lining up the shaft of direct acting engines: "Put two straight edges on the slides, one at each end, run a line through their center points, and continue it beyond the shaft. Set a T-square on one of the straight edges, making one edge of the blade cut the center point. Then erect a perpen licular to the line run, at the center of the shaft, by looking it out of wind with the edge of the T-square." As given here it must be a horizontal engine, is it not? *A.* It would seem so. 2. If the slides should be out of line this method will not do. How find if the slides are in line, without taking out the piston and running a line through cylinder? *A.* The rule you quote seems to be designed for use when the slides are known to be right. The method you mention, of a line through the cylinder, is the best we know of to determine whether they are right or not. 3. In speaking of looking the line out of "wind," I suppose is meant to get it in range with the blade of the T-square, is it not? *A.* Yes.

## BUSINESS SPECIALS.

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James W. See, Consulting Engineer, Hamilton, O.

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A New Treatise on Steam Engineering, Physical Properties of Permanent Gases and of Different Kinds of Vapor. By John W. Nystrom, C. E., 8vo., cloth. Price, $1.50, also A New Treatise on the Elements of Mechanics, Establishing Strict Precision in the Meaning of Dynamical Terms. By John W. Nystrom, C. E., 8vo., cloth, price. $2.00, Mailed by E. & F. N. Spon. 446 Broome St., New York City, on receipt of price.

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## MANUFACTURES.

A new paper mill is being built at Baraboo, Wis.

East Taunton, Mass., is to have a new rolling mill, 180x129 feet.

A large hub and spoke factory is to be built in Denton, Ky.

The Atlanta, Ga., Machine Works are running day and night on gold mills and general machinery.

Priestly & Sons, who run 1,500 steam looms at Bradford, England, are about to remove their works to Philadelphia.—*American Protectionist.*

The Bailey Wringing Machine Company, Woonsocket, R. I., are manufacturing 300 wringers per day.

The Colorado Paper Company, of Denver, Col., will erect several paper mills in Colorado, with warehouses at Denver.

Averill, Russell & Carpenter, Minneapolis, Minn., will rebuild their paper mill, destroyed by fire last June.

The Chicago, Burlington and Quincy Railroad Company, are to enlarge their shops at Aurora, Ill.

The new foundry being built by J. S. Heartt & Co., Troy, N. Y., will have a capacity of 135 car wheels per day.

The Troy Malleable Iron Works, Troy, N. Y., will soon take means to nearly double the productive capacity of their works.

The Cleveland City Forge and Iron Co., Cleveland, Ohio, are building new works, having a frontage of 80 feet on Case Avenue.

J. B. Carr & Co., Troy, N. Y., are crowding the capacity of their works to the utmost to keep up with their orders for cable chain.

The Detroit Lubricator Company, Detroit, Mich., are about to arrange for doubling the capacity of their works.

The Allen Paper Car Wheel Company are making arrangements for duplicating the machinery in their works at Pullman.

The Baldwin Locomotive Works, Philadelphia, Pa., will supply Mexican railways with 200 locomotives.

A large furniture manufacturing establishment is to be established at Fond du Lac, Wis., towards which the city gives a bonus of $12,000.

The Cincinnati, Ohio, Steam Forge Co. will put in a new 17-ton steam hammer, built by Charles F. Elmes, of Chicago.

It is intimated that the general shops for the entire railroad system from Cincinnati to New Orleans will be built at Chatanooga, Tenn.

The Atchison, Topeka and Santa Fe Company is preparing to erect shops at Topeka, Kansas, to cover four acres of ground, and cost, it is said, $200,000.

The Hartford Hammer Company, Hartford, Conn., are making thirty dozen crucible steel hammers per day. Their hammers are largely sold in foreign markets.

Geo. Draper & Sons, Hopedale, Mass., are building a new three-story shop, 80x50 feet, with L one story, 50x50 feet. It will be used for manufacturing spinning rings.

The Loring Paper and Twine Company, Boston, Mass., are making a new towel for wiping machinery. They are woven by special machinery, and may be readily washed.

The Fairbanks Scale Company, of St. Johnsbury, Vt., have leased Abbott's machine shop and foundry, at South Bethlehem, Pa., and will use it for doing general repairs in the district.

William Tod & Co., of Youngstown, Ohio, are building three rail presses, and a large amount of rolling mill and steel works' machinery. They are running double time.

The Smith & O'Leary Steam Hammer Forge Works, Chicago, Ill., have large orders for forgings for the new Mexican railroad; amongst other things, 700 eqalizing bars.

Willard, Sons & Bell, Chicago, Ill., expect to occupy their new steam forge works about the first of December. They will put in several thousand dollars' worth of new machinery.

The Fort Pitt Boiler Works, Pittsburgh, Pa., have shipped to the Edgar Thompson Steel Works twenty boilers, each 53 feet in length. They were made of Singer & Nimick homogeneous steel.

J. A. Fay & Co., Cincinnati, Ohio, manufacturers of wood-working machinery, shafting, pulleys, hangers, etc., are extremely busy. They have just brought out an improved flooring machine.

The Lonsdale Company, Lonsdale, R. I., have recently erected a fine machine shop, and are increasing the size of one of their mills, and otherwise improving their machinery and appliances.

The Motherwell Iron Works, Lancaster, Ohio, will be moved to Logan, the citizens of the latter place subscribing $20,000. The main building of the new works will be 200x50 feet, and will be erected at once.

Holmes, Booth & Hayden, Waterbury, Conn., manufacturers of brass goods, have been making extensive additions and improvements, amongst which are a new foundry, 60x60 feet, and a new stack and chimney.

The Ottawa Iron Works Co., Grand Haven and Ferrysburg, Mich., are full of orders, and run two gangs of men. The shops are being enlarged, and many new tools from the Niles Tool Works, Hamilton, are being put in.

The *Lake Superior Mining Gazette* says the iron ore interests of that region are in want of a method to crush and clean low grade ores. There is an opening in this direction for some skillful man to do this branch of our resources a good turn, and make money for himself at the same time.

The iron and steel works now being erected at Goshen, Rockbridge County, Va., on the Chesapeake and Ohio road, it is said, will be the largest in the South. The company, which is composed altogether of English capitalists, is styled the "Iron and Steel Works Association of Virginia." W. N. Page, of Virginia, is the superintendent of construction. The company has a capital stock of several million dollars. Two furnaces, with capacity for a hundred tons a day each, will be built, and also a large rolling mill and steel works.—*St. Louis Railway Register.*

Kelly & Ludwig, of 49 and 51 North 7th Street, Philadelphia, and 97 Liberty Street, New York, are the agents of M. T. Davidson's noiseless steam pump. They are attaching them directly to the water cylinders of the Otis hydraulic elevators, without the use of tanks, and for other purposes where pumps are required to be without shock or noise under heavy and varying pressures. They are also agents for durable and economical water tube boilers, and patent boiler furnaces for consuming all the gases and causing perfect combustion. W. H. Hoffman is the manager of the New York office.

### Newly Incorporated Companies.

MASSACHUSETTS.

Massachusetts Telephone Company, Framingham. Chas. F. Cutler, Prest.; Willis M. Ranney, Treas. Capital, $150,000. For the establishing and operating lines and exchanges in Massachusetts and adjacent States for the transmission of intelligence by electricity.

Atlantic and Gulf Stream Transportation Company, Boston. Wm. H. Hill, Jr., Prest.; Elmer Littlefield, Treas. Capital, $35,000. To do a general passenger and freighting business between ports on the Atlantic, and the Gulf of Mexico and foreign ports.

Lester & Lyman Manufacturing Company, Montague; E. D. Severance, Prest.; Edward Lester, Treas. Capital, $25,000. For the manufacture and sale of reed musical instruments, and articles appertaining thereto; also hardware and tools, together with the machinery and tools for the manufacture of the same.

Worcester Barb Fence Company, Worcester. Thos. H. Dodge, Prest.; Chas. J. Washburn, Treas. Capital, $15,000. For the manufacture and sale of barb fencing and other wire goods, and articles used in constructing barb wire fences.

NEW YORK.

The Hamilton Straw Lumber Company, New York; Silas H. Hamilton, R. B. Chamberlin and Edmund Coffin, Jr., corporators; Capital, $150,000. To manufacture and sell lumber and other articles in imitation of wood, marble and other materials, out of paper, straw or paper pulp.

The California Hydraulic Company, Buffalo; Jas. M. Bois, R. V. Pierce and W. Alstrom, corporators; Capital, $10,000,000. To compress and transmit air for mechanical manufacturing purposes, by means of hydraulic power.

The New York Plumbing, Building and Manufacturing Company, New York; Wm. R. Farrell, E. D. Norton, Hart Z. Norton, David E. Aiken and Enos H. Norton, corporators; Capital, $500,000. To manufacture and sell plumbing material, ferules and general hardware, etc.

The United States Rifle and Gun-Barrel Company, New York; Cyrus B. Morse, Geo. W. Wingate and H. H. Morse, corporators; Capital, $25,000. To manufacture and sell rifle and gun barrels.

The Sanitary Trap and Plumber's Supply Company, New York; Andrew Campbell, Paul P. Todd and Edmund Kimball, corporators; Capital, $300,000. To manufacture and sell all things appertaining to plumbing, sewering and ventilating private and public buildings.

NEW JERSEY.

United States Spring Car Motor Construction Company, Camden; Robert Steel, Samuel Austin, Frank R. Walton, and others, corporators; Capital, $1,000,000. To manufacture and sell improved car propellers.

New Jersey Mutual Telegraph Company, Newark; Charles F. Peck, John G. Moore and John H. Walker, corporators; Capital, $30,000. To erect and construct a line of electric telegraph, beginning at the city of Camden, thence to Bordentown, Trenton, Newark, Jersey City, Long Branch, etc.

### Machinists' and Engineers' Supplies.

NEW YORK, Sept. 29, 1881.

The active demand for supplies noticed for the past few weeks in our columns does not weaken, and there is every prospect of a continuation. Prices are very firm, and goods scarce. The manufacturers do not seem to catch up with their orders—on the contrary, some of them complain that they are getting farther behind. We hear of no changes in values during the week.

James F. Hotchkiss, 84 John Street, New York City, has just issued a little treatise on "How to Keep Boilers Clean." This little book contains a description of the Hotchkiss mechanical boiler cleaner, with numerous testimonials of its practical efficiency. Much information is also contained upon the care and management of boilers, useful tables, receipts, etc.

Messrs. Brown, Brothers & Co., 37 Exchange Place, Providence, R. I., have just issued a new catalogue of 252 pages, containing illustrated descriptions of almost everything conceivable in the mill supply line. This book also contains rules and tables, and titles of practical books for the use of spinners, managers and millmen engaged in the manufacture of textile fabrics, together with descriptions of new apparatus and devices applicable to the manufacture of the above products. This catalogue is indexed.

### Iron and Metal Review.

The business transacted in Pig Iron during the week has not been large, but the active inquiry continues. Great quantities are being consumed, however, which will have to be reinforced soon. We quote: Foundry No. 1, $25; Foundry, No 2 X, $23; Gray Forge, $21. The prices of foreign irons have advanced to such an extent that consumers will not buy unless compelled to. There is still no Gartsherrie in the market, and the cargoes to arrive, we understand, are to be held at $25. We quote Coltness at $26; Langloan, $25; Glengarnock, $23; Carnbroe, $22.50, and Eglinton, $21 50 to $22. The inquiry for steel and iron rails continues active, but no changes in prices. Old rails have not changed either in demand or prices since last report. Scrap is quoted at $28.50 for No. 1 Wrought; extra store and prime from yard, $30; demand is moderate. Copper, 18¼c. to 18⅜c. for Lake Superior. Straits Tin, 21⅝c.; Australian, 21¼c., and Billiton, 21⅜c. Lead—Common, 5¼c. to 5⅜c.; no refined in market. Spelter—Western, 5⅛c. to 5¼c.; Silesian, 5⅝c. to 5¼c. Antimony, 14c. to 14½c.


## WANTED

Position as Superintendent by a well-known and experienced Machinist and Designer, who is now occupying a similar position. Established reputation and first-class references. Address, SUPERINTENDENT, AMERICAN MACHINIST Office, BOX 14.

A thoroughly competent and experienced steam engineer wants a situation of responsibility, with compensation corresponding to the degree of service rendered. Can furnish every required evidence of ability and reliability. Address, "Chief Engineer," office AMERICAN MACHINIST.

Wanted—Six first-class machinists used to engine work; steady job and good pay. The Hartford Engineering Co., Hartford, Conn., or 72 Astor House.

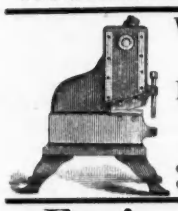
The Ottawa Iron Works Co., Ferrysburg and Grand Haven, Mich., want machinists and moulders: also one good machinist to take charge of toolroom, and one core maker. Men with families will find this a fine opening. Shops thoroughly modern. Healthy and cheap place to live. Permanent places for reliable men, W. F. Parish, Manager.

## S. ASHTON HAND,

MAKER OF

## First-Class Engine Lathes,

TOUGHKENAMON, CHESTER CO., PA.



**WHITCOMB MANFG. CO.**
WORCESTER, MASS.
Manufacturers of
**Hand & Power Shears**
And Punches all sizes.
**Taft's Patent.**
These Shears supersede all others for ease in working, durability and simplicity.

## Engines for Sale.

One new 14x24, slide valve. One second-hand 16x32 12x24, 12x20, 10x20, 9x16 portable, 9x14, 8x14, 6x12, and many others. A full line of good second-hand Iron and Wood Working Machinery. A complete stock of Shop and Mill Supplies. Special western agents for Knowles Steam Works, also for the Tanite Company's Emery Wheels and Grinding Machinery. Our new Steam Jet Pump is the most reliable made; send for circular.

J. H. KERRICK & CO., Indianapolis, Ind.

## ELECTRIC LIGHT APPARATUS.

**A MACHINE AND LAMP COMPLETE** for *Two Hundred Dollars.* Gives one light rated at 2,500 candles. In other words will light a space 150 feet square so that this advertisement can be read easily. Requires about 1½ horse power. Only ordinary intelligence required to run it. Full instructions with each machine. Send for Circular.

**BRADY MF'G CO.**
*Manufacturers of Electric Light Apparatus, Emery Machinery, &c.*
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**NEW ENGLAND MAUFACTURERS AND MECHANICS' INSTITUTE**

fully represents New England Art, Industry and resources. The Exhibition Building is a permanent structure, **the largest in the United States**, alone worth the admission fee to visit, yielding, with annexes, nearly **ten acres** of floor space, and containing Offices, Restaurants and Halls, one capable of seating over **100,000 people**. Artistic, grand, beautiful, ingenious and instructive Exhibition, rivalling in many ways the famous Centennial.

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## Slate Sensitive Drill.

Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a swinging table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for circular.

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Of every description,
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## BLACKIE'S DRAWING BOOK.

A complete course of instruction for the practical engineer, comprising Linear Drawing, Projection, Eccentric Curves, Gearing, Sketching from Machines, Projection of Shadows, Tinting and Coloring. Illustrated by seventy-one plates. Complete in 16 parts, $12.00, or strongly bound in half-morocco, $17.00. Sent free by mail or express on receipt of price. Will instruct without a teacher.

**E. & F. N. SPON, 446 Broome St., N. Y.**

FOR SALE
BY THE
**HEWES & PHILLIPS IRON WORKS,**
NEWARK, N. J.

1—100 H. P. Horizontal Automatic Cut-off Engine Cylinder, 17"x42" new.
1—20 H. P. Horizontal Plain Slide Valve Engine Cylinder, 9"x12" new.
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1—14"x15" Steam Air Compressor, New.
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1—Woodward Steam Fire Pump 3½ Suction.
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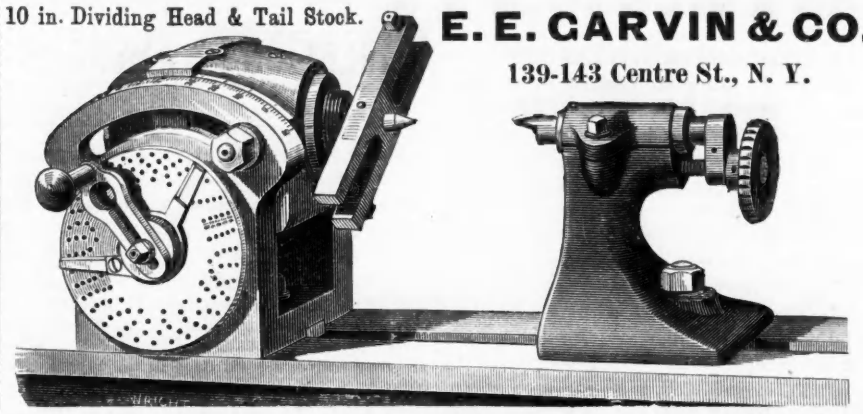
2—2½" discharge Pipes, 2d Hand.
1—No. 1 Niagara Pump, 2d Hand.
1—Double Nut Tapping Machine, New.
1—7Foot Veneer Knife Grinding Machine, capable of grinding convex, concave or straight, very heavy and substantial and calculated for fine work.
1—Improved Car Axle Lathe.
1—57 H. P. High Speed Allen Engine.
1—70 " " " "
1—Large Diamond Band Stone Saw to take cube 8 ft. x 5 ft. x 10 ft.
1—Large Gear Cutter to take wheel 20 ft. diameter

10 in. Dividing Head & Tail Stock.



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This head is well adapted for use **on any milling machine or iron planer.** With it gears can be accurately spaced; mills can be cut straight, conical or irregular in form; taps and reamers can be fluted; worm wheels gashed, &c., &c. Slots in the stock allow the head to be elevated from a horizontal to a vertical position. Supplemental slots in elevating head allow the head to be depressed to 30° below a horizontal line, and 5° beyond a vertical, making 125° of change, all graduated upon the stock. Head is **rigid** in any position. Spacing worm gear is made in halves with means for compensating for wear. 3 index dials accompany the head, dividing all numbers up to 50, and as many others as an ordinary shop practice may demand.

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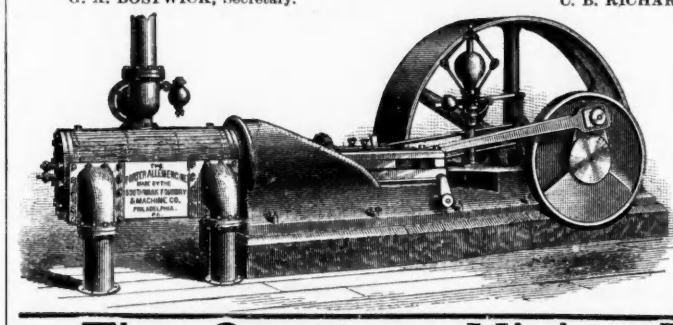

THE SOUTHWARK FOUNDRY & MACHINE CO., Philada., having largely increased its facilities is now prepared to fill all orders for the Porter-Allen Engine on contract time.

Orders solicited for Iron and Brass Castings in the rough.

Address the Company, 430 Washington Avenue, Phila., Pa.

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**Designed for use in Gold, Silver, Coal and Iron Mines. Also for general Manufacturing and Fire purposes.**

Pumps furnished with movable linings in iron, composition or Phosphor Bronze.

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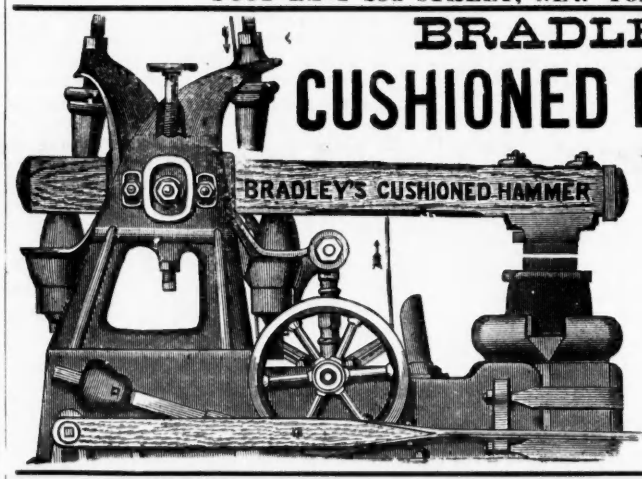


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**WITHOUT AN EQUAL.**

It approaches nearer the action of the smith's arm than any hammer in the world.

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**U. S. Mineral Wool Co.**
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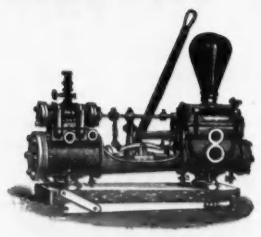
Price, 1 Cent Per Lb.

## Knowles' Improved Steam Pumps,



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